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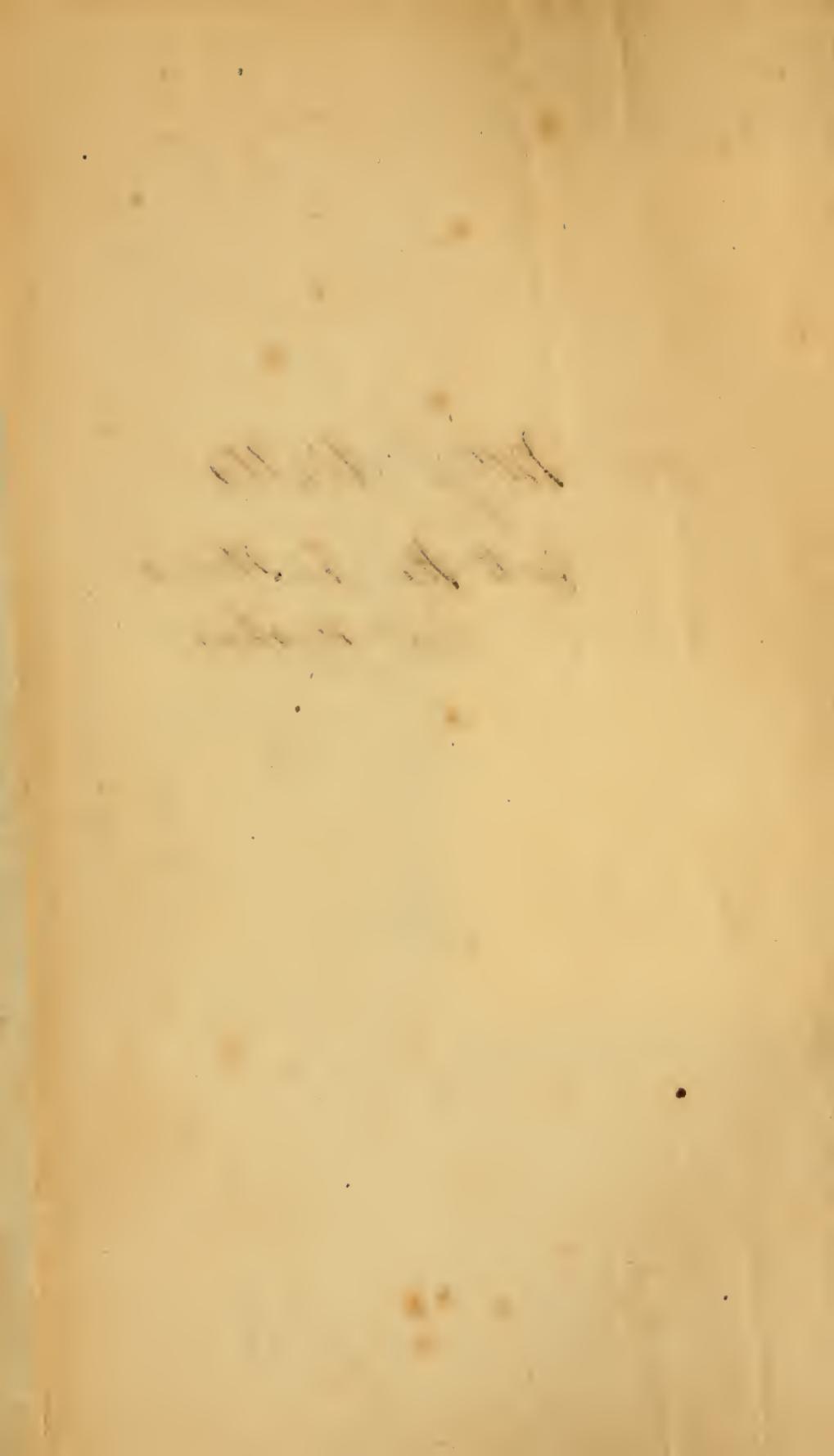
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To Mrs Wills
with her Authors
best wishes





OBSERVATIONS ON HEALTH AND DISEASE,

AND ON

The Physical Economy of Human Life,

IN



CHARLES JOHNSTON, M.R.C.S.



NATAL:

MAY AND DAVIS, 23, CHURCH STREET, PIETERMARITZBURG.

1860.

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TO

SIR ANDREW SMITH, M.D., K.C.B.,

(Late Director General, Army Med. Department),

THE FIRST SCIENTIFIC EXPLORER OF NATAL,

AND

WHOSE EXAMPLE AND RECOMMENDATION DIRECTED THE AUTHOR'S
ATTENTION TO THE UNEXPLORED FIELD OF USEFUL RESEARCH,
WHICH THE NATURAL HISTORY OF THAT BEAUTIFUL
AND INTERESTING COLONY PRESENTED.

Pietermaritzburg, March 20th, 1860.

PREFACE.

DISEASE, when not inherited, is generally the result of ignorance and carelessness. And the ignorance is not merely of the science of medicine, but of many circumstances regarding situation, and the proper care of the body, which it is a reproach to enlightened man to have charged to his account. A century hence it will be looked upon and laughed at as the barbarism of the age, just as we are accustomed to reflect upon the superstitious folly that led our immediate ancestors to believe in witchcraft, and the existence of ghosts. In Natal we shall have less excuse for not improving our knowledge in the direction pointed out, than the inhabitants of the northern hemisphere. Here, by a peculiar dispensation in animal economy, the relations between external nature, and the powers of life, are clearly and distinctly defined; and, moreover, are properly sustained by an apt adaptation of physical resistance in the several organs of the body, to the adverse influences exciting reaction. There, on the contrary, a complication of effect is produced in disease, by a failure in the integrity of textural structure; and to the ordinary causes of functional disorder is added the danger arising from actual inflammation. Symptoms accordingly, which in Natal are conservative, the premonitory and provident expressions of a want of vital power, best supplied by proper nursing, under less fortunate circumstances of geographical situation, are liable to be exaggerated, and converted into so many different mortal

diseases ; arising from the fact that certain conditions of air and climate tend to promote a preternatural delicacy in the structure of the capillary extremities of the circulation, so that they fail physically, and are unequal to support any extraordinary effort of restorative reaction which may be required. Rupture, otherwise inflammation, thus always imminent, has had the unhappy effect of converting the great conservative law of the human economy into a prolific cause of death, and has completely diverted attention from its truly paramount importance, as the basis of all medical practise. The *vis medicatrix naturæ*, save when made a refuge for exhausted theory, has been lost sight of in the chaos of opinion which ingenuity and curious inquiry have raised, to explain what was unintelligible when only one key existed, and that unknown, to solve the innumerable phenomena connected with the development of disease, and with the *modus operandi* of the equally numerous remedies contained in the various pharmacopœas of the northern hemisphere.

A residence of some years in Natal has completed my medical education. There I found restored nature's vital predominance over her mere material forms. Sufficient, by the powers of life alone (whilst her mysterious element is properly supported by warmth and proper nourishment), to subjugate or repel any adverse relation of external origin. Disorder is only apparent in her efforts to restore tranquillity in a temporarily disturbed economy. The nature of meteorological influences is such as favours a development of capillary resistance suitable to the extraordinary exertion, when occasion demands it, of reactionary forces. Restoration to health thus becomes a natural effort in the system, that only requires not to be ignorantly interfered with, or carelessly neglected, to eventuate in recovery.

The immediate dependence of vital power upon proper nourishment, was the next conviction due to my profes-

sional experience in Natal. I observed in children that good nursing amounted to perfect immunity from disease ; and applying the suggestion to the treatment of the various forms of disorder I encountered, I was not long in discovering the common character of all ; their unity consisting of a want of vital power to react against depressing influences of climate or bad habits, and that this want is chiefly owing to sufficient nourishment not being conveyed into the system. How I have extended my experience to illustrate and utilize the axiom of Hippocrates, upon the unity of all diseases, and have supplied a radical type, will be seen in the following pages. All I ask is due consideration for the circumstances under which I have completed my task. In a distant colony, without books or instruments, and no British Museum library for convenient reference or consultation, a student of nature is a literary Robinson Crusoe, building a boat, and very badly off for tools and necessary assistance. For instance, after writing pages upon the conversion of food into the *pabulum vitae*, based upon the most approved principles when last I had the opportunity of consulting the best authors upon the subject, some ten years ago, I was obliged to cancel and re-write all, from accidentally meeting with two recent numbers of *Blackwood* (June and August, 1858), where, in a physiological *critique*, I found some previously received doctrines, upon the subject referred to, refuted and condemned. Again, in drawing up my meteorological account of the climate of Natal, I have been obliged to depend upon two records (the only ones available at the time) of thermometrical and barometrical readings, carried over several years—one contained in the *Witness* newspaper, and supplied by the praiseworthy zeal and attention of George C. Cato, Esq., of Durban ; the other a similar record kept in Pietermaritzburg, at the office of Theophilus Shepstone, Esq., Secretary for Native Affairs. Under such circumstances, exactness or extent cannot well be expected ; nor have I pretended to an accuracy such as I could have

wished, had I been better provided with the means of authenticating and confirming my more speculative observations. But if, after all, a certain confidence of assertion is observed, and felt to be presumptuous, for this I ask excuse, as a failing of temperament which signifies nothing more than that I am myself convinced, and not that I wish to impose summarily or of course upon public opinion, or without due examination of the merits of that which I am advancing as truth. A decisive tone often challenges discussion, and promotes what is right by exciting a jealous scrutiny into the value of assertions made; and as I live only to learn, even when shown to be in error, I recognize advantages in adverse criticism which I do not wish either the world or myself should lose the benefit of.



OBSERVATIONS

ON

HEALTH AND DISEASE

IN NATAL.

CHAPTER I.

Introductory remarks :—opportunity of free discussion—professional responsibilities in an infant settlement—old things fade away—new lights—a reproduction, divested of rust and abuse. Definitions :—Life—Health—Disease—Death. Division of general subject :—the sources—the support—and the physical economy of life in Natal.

IN the hope of being useful in my generation, it is with some degree of pleasure I proceed to place on record those observations on disease in Natal, a residence of eight years and upwards has enabled me to make. Seldom, indeed, has a medical man so convenient, so legitimate an opportunity of popularizing the divine art of healing. In the old country such attempts are invariably discountenanced. The profession, from a mistaken conventional propriety,—and the public, from an almost superstitious reverence for

chartered authority,—there unite to discourage any zealous medical reformer, who may propose to remodel and simplify the present unsatisfactory system of medical practice. Of this, it may be truly said, that it lags far behind the enlightened spirit of the age, and falls very short of the requirements of modern society. Of course, I do not pretend to deny that the general practitioner—in which term is now included physicians, surgeons, and apothecaries—by a law of progress no privileged classes could withstand, has advanced in professional acquirements, *pari passu*, with the astonishing advance made during the past fifty years in all the sciences. But this advantage of modern times is shared in, equally, by the natural historian, and every well read student of general philosophy; another significant indication of the tendency of increasing knowledge, to break down the artificial restraints which have hitherto shut out the mass of mankind from the study of health, and placed the science of medicine, and the practise of healing, in the hands of a particular class.

Nor do I presume to say, that good has not resulted from the system previously pursued. On the contrary, I believe that no other ordering of events, could more effectually have operated to bring about that glorious consummation of enlightened mind, and active humanity, which so markedly characterize the medical profession of Great Britain. Circumstances in Natal, however, are favorable for supplying many acknowledged deficiencies in the proper practice of physic, and for the correction of every abuse of position or influence, which in England has some old prejudice, or some stiff interest to do battle in its favor, and show fight against reform. In establishing medical institutions here, we have no excuse for losing sight of the general interests of society, either to indulge an affection, or to gratify a whim. Old conflicting privileges and customs may look antiquated and respectable, but they are neither convenient, nor would they be creditable to our common sense. On the other hand, modern intelligence requires in operation an improved system of sanitary economy, both socially and individually considered, and a serious responsibility is incurred, if the opportunity offered to us should be neglected or overlooked. At all events, I seek to acquit myself of a conscious duty, by addressing myself on this occasion to the colonists of Natal, generally, on a subject of such vital importance to their happiness as

the proper care and preservation of health. The advertisements of *Holloway—Morrisoniana*—the praises of *Revelenta Arabica*—and a host of similar absurdities, are to me, as a professional man, a continual reproach, whilst the incongruous doctrines of the Homœopathist, the Hydro-pathist, and the Animal Magnetizer, are stumbling blocks, which a conceited, but easily humbugged, ignorance, delights to place in the course of practice, when legitimate science fails to satisfy unreasonable inquiry, or to explain what providence at present chooses to shroud in obscurity. In fact the character of popular medicine, as reflected in the periodicals of the day, is at once my best apology, and my most sufficient reason, for intruding with a questionable novelty, professional experiences and advice in the popular form I intend them to assume in this volume.

Before closing these preliminary observations, it is also fitting I should here propound some arrangement of my subject, which shall not only make me readily understood, but contribute to the easy recognition of disease by persons unaccustomed to observe, until some unhappy circumstances of trial, throw them, unassisted by professional knowledge, on their own reading and mental resources. I need not say in a new settlement, how frequent, and how serious, these occasions are; nor dwell, as if my readers were unaware, of the confusion and anxiety that prevails, not to mention the loss of valuable time, when no authority or guide is at hand, to direct or suggest the necessary course to be pursued.

As upon a calculation by a French authority, upwards of three hundred thousand medical works have been published for the benefit of the ardent student, it must be granted, that to condense this amount of varied information into a hand-book of three hundred pages, appears little less astonishing than the bottle trick of the conjuror, and were I not in the secret of professional polemics, would perhaps be sufficient excuse for not attempting any such apparent impossible task. As, however, my intention is to ignore, as much as possible, this mixed mass of a few great and important truths, with much superficial observation, extravagant theory, and imaginary experience, I shall not dwell longer on the subject, but proceed in, I hope, a conscientious endeavour to reduce to the level of ordinary human understanding, the transcen-

dental obscurity of the philosophy of life, health, and disease, as found in medical works, and in the present practice of physic.*

The best course to introduce my subject, and method of treating it, will be to begin with definitions, as from these we shall glide into such disquisitions, as will, gradually and naturally, unfold the information I have to give, and be the basis of an arrangement of its various parts, convenient for separate discussion, and easy retainment by the memory. Life, health, disease, and death, are sufficiently contrasted in their relations to each other, to constitute this required division, and, accordingly, I have adopted it; but, let it be understood, however exalted these principles may be, when treated in an abstract or philosophical sense, here, their definitions will be made subservient to, and are only intended to make more clearly appear, the practical worth of my remarks upon the effects of situation, climate, character of food, and occupation, upon the human frame, as observed in the colony of Natal.

To begin:—*Life* may be said to be the development, in a prepared organism, of certain operations sensible in heat, animal electricity, and the nourishment of the body. The abstract consciousness that directs and selects material to this end, is too subtle to admit of closer analysis. Here, however, it is not necessary to enter into its nature and constitution. It is sufficient to recognise its existence as the remote or ultimate cause of all vital phenomena, and dismiss it from further consideration as an unknown quantity, which does not affect the solution of the problem we have more immediately to do with. Life, as a medical question, is simply the continued self-support, and power of self-renewal in generative succession, of various specific functions in an organic system, expressly designed for the purpose, and which we call the body.

* Macculloch remarks, in the preface to his valuable work on marsh fever,—“The language of truth is simple and brief: but this is not the language of physic. Its words have meanings, and the same words have always the same meaning. The language of error is multitudinous, variable, vague, and unsteady: and this is the language of physic. If there be a philosophical reader who doubts this, if there be a logician, a man accustomed to evidence, who has not read medical books, let him read even the most celebrated and be satisfied.”

When man came from the hands of his Maker, complete and excellent in constitution, *Life*, we must suppose to have had no comparative relations, and the revolving change of individual necessity, between the womb and the tomb, must have been as easy and natural as the alternations of day and night. Where sorrow and selfish fear did not exist, birth and death would seem a happy union of new capacity, with a period of renovating repose:—*life*, the interval of enjoyment. All ages would have their own progressive unfoldings of new beauties in creation, and experience would have no repinings, and, consequently, no suggestions for hope or idle wishes. Contentment would mark the participation of man in the universal harmony of all nature with its God, in the primeval paradise of Eden, where, as we read, “Behold! everything was good.”

However, we have been shut out from all this, and although the abstract definition of life must always consist of the same major, minor, and conclusion, as when it was first developed, its character and condition in man has changed, reflecting the consequences of the fall in characters quite as legible, as do the moral correspondencies of good and evil, the first knowledge of which also marked this most eventful era in the early history of the world. The comparative conditions of health and disease have been superadded to human experience, and the word *life*, now includes no idea of continued enjoyment, free from unnatural vicissitudes, but, in popular language, expresses nothing more than a mere state of being, the necessary and consequent antithesis to what is understood by death.

With this altered state of things a modified expression has become to be used, to describe man’s actual physical experience in that partial relation to life, which human nature at present exhibits. Vital power, or constitutional strength, is an adapting expression to individual circumstances, all men having, each his own personal enjoyment in being, and over the amount of which he exercises considerable influence, either to diminish or increase. By contract,—on trust,—he has meted to him a quota of universal existence, the divine life breathed into his nostrils when he became a living soul. At birth he takes possession—at death renders up his account, and the interval between is a mixed condition of health and disease, circumstantially allied to the moral developments

of the individual, which education or neglect may have contributed to foster or deprave.

We have next to consider, in what does *health* consist. It has been described as life undisturbed by disease; but this is, clearly, to make it synonymous with *life* in its original sense. And this objection holds, that to understand the nature of health we must have the experience of disease, a condition incompatible with the normal excellence of life. I prefer, therefore, to describe it, as reflected in a previous allusion, to be a variable standard of vital strength, which governs individual constitutions, and to the utmost of its power, renders inevitable decay,—gradual, imperceptible, and slow, till death comes the assigned close, in a systematic course of nature, of that finite state of existence which birth commenced.

By *disease*, I wish simply to be understood, all disturbances in the human system, incompatible with the full enjoyment of life. Its principles, honestly discussed, are very few, and easily comprehended. Though “fearfully and wonderfully made,” man is not beset with such constant cause for anxiety from this source, as might be presumed, from the enormous mass of books written upon the art of healing, even admitting their value, to record and communicate the experiences of numerous observers. Nature only asks man’s individual attention, and he will soon find, that the knowledge of a few simple laws, a prudent watchfulness of her indications, and the exercise of ordinary common sense, are all that is required to guard against the approach of preternatural disease, and provide for the progressive decay, and death of the body, as the natural consequence of life developed in a physical and mortal form.

In the last place, I would remark of *death*, that it is the removing operation of a law of mortality, supreme over matter, and which limits human existence, and measures out its span, in common with the whole visible universe. In birth, man comprehends a beginning, and sees the end of all created things in death, for, individual experience terminated, so, also, are all mortal relations, and *beginning* or *end* can have no signification in an existence separate from matter. To define death, however, as a mere negation, the absence of life, would be wrong and presumptuous, whilst reason and revelation both attest, that it really is an introduction to another state of existence.

But, besides these particulars,—life—health—disease—and death,—which I have attempted in a few words to raise, from the level of ordinary consideration, to the dignity of a suggestive philosophy, as a fitting preparation for minds coming new to the subject, it is my intention, in this preliminary chapter, further, to project the plan upon which I intend to proceed, basing my observations on disease in Natal, upon three general principles of discussion,—the *sources*—the *support*—and the *physical economy* of human life, under the particular local circumstances in which we are placed.

By the *sources* of human life, must not be understood the *relation* of parents to children. This, refers to individuals: that, to the whole human race: and, in the latter sense includes all those various influences external to the frame, and beyond his control, yet known to affect the constitution of man, and to decide his general character. Hippocrates, the father of medicine, justly observes, “The varieties of the seasons are the most powerful causes of the different natures of men. Next to these is the quality of the soil on which they subsist, and the waters they use. It is certain that, commonly, both the physical and moral constitution of man, is conformable to the soil on which he lives.” So convinced, indeed, were the ancients of these influences, for good, or for evil, that inspections of the livers and viscera of the indigenous animals were always made by officers appointed for the purpose, previously to taking possession of a new country, and establishing a colony there; for it is worthy of observation, that the changes produced in the frame by peculiarities of situation, are not confined to the human race, but are shared in by the whole animal kingdom.*

Further, I would observe, that the *sources* of life, contained within itself by a favored land, and promising health and beauty, mental capacity, and length of days to its inhabitants, can be as easily proved, as may the evils which

* In agueish countries cattle are most frequently affected by diseases of the spleen, and, in England, it is usual even to send sheep into low marshy pasturages, to increase in bulk at the expense of the liver, which under such circumstances invariably becomes diseased. It has also been observed, in localities favorable to the production of *bronchocele* or *goitre*, that it affects animals as well as the human species: dogs, sheep, and cattle being subject to it.

threaten its enjoyment, arising from insalubrity of location, or inclemency of climate. We notice general effects, and perceive contrasts of character, which mark the various families of man, and, rightly enough, ascribe them to local influences. The differences in form, and natural disposition, observed between a highland people, like the Scotch and Switz, on the one hand, and the inhabitants of a low, fenny country, like Holland, on the other, are so obviously the consequences of geographical situation, that to mention the instances is sufficiently to illustrate the fact. Again, the hardy, adventurous islanders of all archipelagoes, owe something more than mere life to their sea-girt homes, whilst the heavy, lethargic agriculturist, of the corn countries of interior Europe, especially in Russia, is another contrasting proof that country moulds human character, and *makes* man in a general sense.*

* To add to common observation, the authority of a venerable name, and to show how early a knowledge of the fact influenced medical philosophy, I shall quote here, some remarks of Hippocrates contained in a treatise, "upon air, water, and place," and the influence they exert on the human constitution :—

"I will add a few words concerning the inhabitants of the Phasis. Their country is marshy, warm, watery, and thick-set: much rain falls during every season. The inhabitants live in the marshes, having houses made of wood, or of reeds constructed among the waters; so they walk very little, except when they go to the city and market, but they sail up and down in boats made out of a single piece of wood. There are many ditches, and they drink hot and stagnant waters, putrified by the sun, and increased by the rain. The Phasis itself is, of all rivers, one whose course is the most sluggish. All the fruits of the country are unwholesome, without strength, and crude, from the superabundance of water; nor do they ever ripen. Many fogs from the waters cover the face of the country.

"For these causes, the inhabitants of the Phasis are in their appearance different from other men. Their size is large, their bodies corpulent; the joints of their limbs are not visible, nor the veins; their color is pallid, as if suffering under jaundice; they speak the slowest of all men, living in a dull, obscure, and moist atmosphere; and they are in their bodies slothful, and unfit for labor."

In another place, Hippocrates, instituting a comparison between the more robust, energetic, and adventurous spirit of Europeans, and the timid effeminate character of the Asiatics, attributes the difference chiefly to the effects of opposite climates, but, at the same time, he seems perfectly aware of the modifying influence of political or social institutions upon man's moral character. Almost all Asia," he says, "is under the dominion of absolute monarchs; a condition which, by necessity, engenders cunning, selfishness, and

To apply these considerations to ourselves, every colonist in Natal is interested in watching, carefully, all the phenomena of life and nature, within the scope of his understanding, connected with the numerous varieties of situation, the surface geography of this colony presents. In this manner might be collected a mass of observations, which, reduced to exact knowledge, would solve all questions of comparative good or evil, as regards the character of climate, or the salubrity of our adopted country. In its proper place, when describing more particularly, the general aspect and physical history of Natal, I shall endeavour to point out the more prominent natural features, and the extent of our present information, which is very insignificant in amount, and scarcely creditable to us as Englishmen, boasting of our enlightenment, and of inheriting an active, energetic, and inquiring spirit, the national characteristic of our fatherland.

The second division of my subject, the *support* of human life, will lead me to the consideration of several vital phenomena, connected with nutrition, secretion, and the production of animal heat. This will render necessary a systematic, if not a very minute descriptive explanation of the various organs of the body, and their several functions; but I shall endeavour to popularize this information as much as possible, and be well satisfied if I can thus succeed in conveying correct ideas of the machinery of life, assisted by striking illustrations or analogies drawn from natural history generally, rather than uselessly to tax my readers' patience with labored accounts or minute details, which, after all, he would not understand, and, very probably, not even read.

And lastly, the *physical economy* of human life, is a division of my subject, which will afford me the opportunity of discanting upon the prophylactic and curative measures necessary to protect or to remove from the body, the consequences of accident or error, when these may threaten, or have interfered with, the normal condition of the various organs, and produced ill-health. Under this head, therefore, will be discussed the specific character and symptoms of disordered action, in the several viscera and

pusillanimity; the Europeans, on the other hand, possess liberty and property, living under the safeguard of laws; which produces a character marked by boldness, pride, and independence."

tissues that build up the human frame,—the nature and effects of the various remedies employed, with those observations upon diet, and the discipline of daily life, which my experience has led me to believe best adapted to secure health—give relief from disease—and promote longevity among the interesting missionary population, that has been sent to occupy a new land of promise, and found the future of the Colony of Natal.

CHAPTER II.

General description of Natal:—geographical situation—peculiar river system—great natural highway—marine current on coast extent of trade winds—effect of continent upon atmosphere—barometrical anomalies. Local winds: rain-bearing, or southwest wind—house-burning, or north wind—fine-weather, or east wind—electrical disturbances—action and reaction of land and water—climatic zones—variable in coast district—of clouds in intermediate region—of extremes in the highlands—seasons. Geological structure—former operations of nature—basis rocks—character of secondary formations—the tertiary period—changes in progress—extension of rivers—numerous estuaries—lakes and sand dunes—the bay of Natal—the Bluff—advance of coast line. Ethnological relations of aborigines of Natal:—past history—first discovery—character of natives—language—opinions of early visitors—recent travellers—general review and conclusion.

It is no idle conjecture, that a philosophic mind, in ages long gone by, might easily have deduced the glorious destiny of England, from her geographical position, and her internal natural resources, had these, at the time, formed part of general knowledge, and been laid open to the eye of reason. So, with regard to Natal, hope may fairly indulge in contemplating her possible history, for in the character and situation of its coast line, and in the peculiar features of its surface geography, a well informed and reflective mind, abounding with ideas drawn from analogy, and conscious of the wants of Africa—of the promises of Christianity—may see the relation of circumstances at present existing, and safely predict the future greatness of our young colony, and the interest which will always attach to the history of its rise.

The work requires a healthy race. A sound mind in a sound body is a necessity of progress. To point out, on the one hand, the advantages—on the other, the incongruities of local situation with the requirements of the human constitution, is part of the subject I have under-

taken to elucidate. It will be necessary, therefore, in this chapter, to digress extensively on the natural features of Natal, dependent upon its geographical position and geology, for the purpose of explaining many phenomena connected with its climate, and to give a reasonable explanation of the belief I entertain, that a progressive improvement in every physical condition, favorable to human life and exertion, may be confidently anticipated of the future in this colony.

A coast line, extending from north east to south west, and extending from the river Tugela, in latitude 29.20 south, to the river Umzimeulu, in latitude 30.55 south, barely two degrees, forms the eastern boundary, on the Indian ocean, of the colony of Natal. To the north is Panda's country, occupied by Zulu kafirs; whilst on the south are the Amapondas, under the mild rule of the aged Faku. Towards the west, Natal reaches to the summits of the Drakensberg, occupying a numerous succession of broad, grassy terraces, that by an easy ascent, though after a circuitous route of nearly two hundred miles, conducts the traveller from the level of the sea at Durban, to the height of about 6000 feet, where the road crossing the ridge at Harrismith, leads to the Orange river Free state, and to our still nearer neighbors, Moshesh and his subjects, the Basutos. The Drakensberg, west of the Klip River division of the colony, preserves a remarkable parallelism with the coast line at a distance, by crow-line, of less than one hundred and fifty miles. Where, however, Moshesh's country, in the same direction, overlooks the Umcomas division, the ridge abruptly advances some forty or fifty miles nearer the sea, but preserving, as it proceeds to the southward, its characteristic parallelism, although the face of the mountain range here exhibits far more rugged features, and has hitherto proved inaccessible to the several exploring parties that have sought, in this direction, a new and direct road through Moshesh's country, to Bloem Fontein and the old colony.

The rivers that traverse the colony possess a singular uniform character of origin and course, sufficiently general to constitute a particular system, the peculiarities and interesting natural operations of which, have not hitherto arrested the serious attention of naturalists. The examination, however, will, I believe, assist in solving many questions of great geological importance, and pro-

mises a field of inquiry admitting, much more than is usually the case, of exact knowledge in well demonstrated results; and where also, let it be observed, speculation, when required by circumstances, must be decided and bold, to be considered reasonable, and worthy of being entertained.

A geological map of Natal would not depict in colors the ages or characters of its rock formations. The succession of its principal streams would, with more propriety, be so distinguished, for as in one family we discern several intermediate members, from the infant to its grandsire, so can it be shown, that between the as yet unnamed streamlet, it may be a mere wagon-track conveying its first rain shower to the beach, and the wide-spreading, far-reaching Tugela, probably the first-born of Natal rivers, an intimate relationship exists, which unites with these extremes, in one historic series, the middle aged Umgeni, the Umbilo, of the tertiary period, and the still more recent Umslatuzan, of the Bay of Natal. Denudation, on the one hand, eating backward into the Drakensberg, and constant encroachment on the ocean by alluvial deposit, and the continual drift from seaward, on the other, have combined to produce, in the course of time, a long sloping *talus*, on which, as it extends towards the east, and enlarges the borders of Natal, new rivers rise. These, again, prey on the terrace beds of their predecessors, gradually denuding the weather side of each succeeding plateau, until its valleys are broken in upon, and reduced to mere affluents into the intruding stream. In this manner, the latest produced rivulet, on the constantly accumulating downs of the coasts, eats back its course, invariably triumphing over its elder kind, for, marking a lower course to the sea, when denudation has opened a communication, it becomes the natural channel for the contained waters to escape. It will also be observed that, under these circumstances, the sources of Natal rivers become gradually raised, from the level of the coast line, to the summits of the Drakensberg. Although imperceptibly, except in the accumulated results of ages, it is also certain, that every wet season degrades a small, but appreciable quantity of the Great Orange river basin, occupying the counter slope of this elevated region, and consequently the falling rain, which last year was conducted to the west, and south Atlantic ocean, will, during the next, dropping in exactly the same line, be

conveyed in new channels, by Natal rivers, to the Indian ocean and the east.

Another striking feature of the surface geography of Natal must next be considered. The united testimony of travellers and traders affirm that the long tract of country of variable breadth, intervening between the Drakensberg and the sea from Algoa Bay to Delegoa, has but one pass over the mountains available for intercourse between the inhabitants of the two opposite slopes, without an amount of labor, and circuitous travel, which has deterred all direct trading adventure among the numerous Kafir tribes, that, with their herds, occupy the deep kloofs, or scale the precipitous steeps, of this rude and rugged district. The patience and perseverance of the zealous missionary alone, has carried whatever of civilization is known among these almost inaccessible wilds.

In Natal, however, traversing its entire breadth, a natural road exists, which reaches the summits of the Drakensberg range by the easiest of ascents. But a little human ingenuity applied, and the expenditure of a few thousand pounds, and it is not extravagant to assert, that that the whole distance might be cantered along, or a wagon descend with wheels unreimed, without cause of distress or fear to interrupt the experiments. Here, through innumerable ages, perhaps ever since the fall, nature, or some convict angel bound to the spot, has been diligently and silently at work, to prepare a means of communication with the interior, when man, enlightened by the religion of Christ, would require some such provision to call him, and lead him, to the divine work of human regeneration, the continent of Africa presents. The eternal fitness of things, and the coming fulness of time, are certainly linked in Natal to the fulfilment of God's promises to man. A sphere and an agent are brought together there, and these two being granted, by a species of mental arithmetic, the conviction of blessings about to be unfolded, becomes an instinctive conclusion—a moral truth.

But, reverie aside,—the question naturally arises, how has all this been effected? The principal cause that would first suggest itself, to any one who had resided for some time in the colony, would be the conflicting action of the two prevailing winds, from the opposite quarters of the north-east and the south-west. The former being dry,

genial, and warm—the latter, cold, blustering, and wet. The direction of the great natural viaduct would follow the line of equilibrium, or of neutralized force, between these two contending powers of the air, that seem to have made Natal their battle field, each alternately prevailing for a season, and after an equinoctial struggle, sullenly retiring before its rival's right of succession. It is natural to suppose, that the line of equal forces above, would determine the line of least denudation below, and that this negative influence would be sufficient to produce a marked topographical feature, in a locality where the disintegration of rocks, from atmospheric causes, is both extensive and rapid. And this general view is, on the main, a correct one, though only part knowledge, for there are several other circumstances of interest and importance, engaged in this great work of nature, well worthy of the reader's attention, especially as describing them will also afford favorable opportunity for conveying information upon the climate of Natal, the character and constitution of which are materially affected by the same causes, that operate to mould its surface geography.

In the first place, the direction of the prevailing currents of air, the north-east and south-west, blowing alternately, with uncertain duration, in all seasons of the year, is a local feature of such systematic irregularity, that no attempt to explain it would be a serious omission on my part; yet, to enter into the subject at all, requires some notice to be taken of general meteorological phenomena connected with the natural history of the great Indian or Southern ocean. For example, our so described south-west wind, may be proved to be a modified result, owing to local influences, of the almost constantly blowing south eastern trades, within the parallels of latitude in which Natal is situated. In asserting this, however, it is necessary to show, although the theoretical limits of these winds in both hemispheres, is the twenty-eighth or twenty-ninth parallel of latitude, that in the Indian Ocean, especially during summer; and on the eastern coast of Africa, what evidence does exist, favors the idea that the trades extend to between thirty-one and thirty-two degrees of south latitude. The totally different circumstances indeed of the two situations, the North Atlantic, in one hemisphere, confined between the two continents of Europe and America, and, in the other, the great Southern ocean,

extending uninfluenced, by the contiguity of land, for nearly one-fourth of the circumference of the globe, would warrant even a bolder presumption; and it is certain that, during the summer months, from November to April, when the sun is south of the equator, the influence of the trade winds is expected by voyagers to India, very soon after passing the Cape of Good Hope. As, however, the south eastern coast of Africa presents several other physical causes, calculated to affect, materially, the normal distribution of general currents of air, and modify their course and character, I shall proceed to notice them here, as being intimately connected with the geographical situation and climate of Natal.

Of these, the most remarkable is the presence, in its immediate neighborhood, of a remarkable body of heated water, part of the great oceanic stream which, taking the course of the Mozambique channel, and along the eastern coast of Africa, constitutes the powerful and often described marine current, that sweeps round the extremity of the continent. The character of its origin and course is very analagous to that of the celebrated gulf stream of the North Atlantic ocean. Commencing near the equator, about the meridian of ninety degrees east; its first direction is in a long curve towards the north of Madagascar, this island dividing it into two parts, one following the line of its eastern, the other of the western coast. It is the opinion of many, very competent to judge, that the divided stream reunites off Natal, as portions of large wrecks, drift cocoa-nuts, sea-weed, and other debris of tropical seas, accumulate in vast quantities near the mouth of the Unizimcaarba river, in latitude 31 deg. 10 min. south, where the *Grosvenor*, and other large Indian "argoses," before and since, are known to have come on shore. From this point the current, in nautical language, closely hugging the shore, runs with increased velocity to the south and west, being finally lost in the neighborhood of Cape Agulhas, where it meets with an antagonistic stream, coming, but with far less volume and power, around the Cape, from the north and west. Like the gulf stream, the waters of this Natal current, to give it a name, are found to have a much higher temperature than the surrounding ocean, and consequently must have a great effect upon our climate and vegetation. By its influence the mean annual heat in Natal is several degrees higher

than would otherwise be the case, and which will account for the indigenous growth of many intertropical plants, especially along the seaboard, that here appear at some distance from their assigned *habitats*, in a rigid system of physical geography.

In the absence of anything like proof from the observations of myself, or others, on the physical characters of the Natal oceanic current, little value can attach to dogmatical speculations of what might, or might not, be found to be the facts relative to its varying velocities and temperatures in different parts of its course, when the attention of the scientific world shall have been directed to our want of light upon the subject, and competent observers are stimulated to seek this wide unoccupied field of inquiry, wherein to acquire reputation, and advance general knowledge. At present, the ignorance of the world upon the natural history of the southern hemisphere, as far as regards South Africa, and the great southern ocean, is inconceivably great. The former remains, still as ever, the domain of wondering indifference. As of old, even to a proverb, unless something new and extraordinary arises, it seems difficult to induce the public, learned or unlearned, to take any serious interest in its condition or destiny. These reflections struck me forcibly, in my unavailing search for information connected with this work, and for authorities to guide and assure me, when seeking to explain to my readers, correctly and satisfactorily, numerous physical phenomena, and incidents of natural history, novel and interesting. This neglect of South Africa contrasts so singularly with the amount of genius and industry which have been engaged in South American research. Of the array of naturalists, with the venerable Humboldt as the leader, who have devoted their time and labors in this field, it may be said their name is Legion; while Africa, bare and solitary ever,—widowed, mourning, and alone (Niobe weeping over her children,—turned to stones by the sun—no inapt personification), has had the most scanty notice vouchsafed to it in those general pictures of nature—cosmical panorama—drawn by most able hands, and which have in modern time at once adorned the temple, and delighted the votaries of science. Concerning this part of the southern hemisphere, everything is vague speculation or uncertain knowledge. Everywhere, surmise rests on no, or very imperfect, foundations, and even

a species of repulsion may be observed, in the manner in which considerations, connected with its natural history, are approached. These are dismissed in a few lines, frequently constituting a mere incidental remark, as if suggested only by a presumed analogy with the circumstances or situation of some other locality; and, when directly alluded to, it is with such a scanty unsatisfactory notice, that it seems to be less for any useful or definite purpose, than to avoid a charge of carelessness, in projecting systems of physical cosmography, by having overlooked an extensive, if not a very important, section of the earth's surface.

Under these adverse circumstances for obtaining exact knowledge, to enable my readers fully to comprehend the nature and value of the Natal current, as affecting climate, my only resource is to illustrate by corresponding well known phenomena elsewhere, and draw a reasonable inference from these, where it is impossible to proceed on conclusions drawn from established facts or careful observation. For example, we have a remarkable instance of a similar oceanic current stretching across the Atlantic between Cape Hatteras, in North America, and the Azores, forming in the ocean a constantly flowing stream of warm water, of not less extent than the Mediterranean Sea. Part of the equatorial current, it pours itself from the Caribbean Sea, and the Mexican Gulf, through the straits of the Bahamas, and following a course of from southwest to north-east, along the coast of the United States, to latitude 35 deg. north, where it is deflected to the eastward by the banks of Newfoundland, until it reaches the shores of Europe, frequently throwing drift wreck, and a quantity of tropical seeds, on the coasts of Ireland, the Hebrides, and Norway. During its course, its temperature is from 3 deg. to 10 deg. higher than that of the surrounding sea. Along the coast of America it loses little of its heat; at Cape Hatteras, after a progress of 900 miles, the stream being only 3 deg. cooler than in the gulf of Mexico. From this point, as it flows to the north and east, across the Atlantic, its decrease in temperature is somewhat greater, but even off the coast of Newfoundland, after a course of 1500 miles, it has only lost 5 deg., and is then from 8 deg. to 10 deg. of Farenheit above the adjacent sea. Until recent observations had completely established and confirmed these facts with many collateral

and dependent ones, the influence of the Gulf stream in moderating the climate of Europe, had been altogether overlooked. It is now, however, universally admitted that the extraordinary difference in the temperature, amounting to from 8 deg. to 10 deg., observed between the western countries of Europe, and those of America, in the same parallels of latitude, on the one hand, and of Asiatic countries similarly situated, on the other, is due to the presence of this vast river, or lake of heated water, constantly circulating in the midst of the Atlantic ocean, and over which, it must be observed, is always a volume of air several degrees warmer than the atmosphere more to the west and to the south. By the action of the frequent gales, always to be expected in navigating the Gulf stream, and generally blowing from the south-west and west, in sudden gusts, with short intervals of calm, the warm superincumbent air is wafted in genial breezes to the leeward, over the countries of western Europe, tending to moderate the cold of the ocean, and ameliorate the climate, even as far as the North cape. They are impelled, also, through the wide gap existing between the Hartz mountains of Germany, and the more northern Scandinavian ranges into the recess of the Baltic Sea, and as far inland as the plains of Russia, where they are finally met with, and lost in the cold blasts of the, there, constantly prevailing north-east winds.

The principal points of resemblance between the Natal current and the Gulf stream, is that both seem to be the direction taken by the waters of their respective equatorial currents, when the nearly due eastward course is interrupted by the adjoining continents. The wasting operation upon the land by this constant waterwash of the Indian ocean, is observed in the deep indent formed between Arabia, and the opposite coast of Africa. The counterpart of this in the western hemisphere is the Gulf of Mexico. Again, we find the Gulf stream rushes from south-west towards the north-east, whilst the Natal current, also escaping towards the pole, takes exactly the reverse direction, in accordance with the law of reciprocity adapted to the two situations, and which, by currents and counter currents, above and below, in the water, as in the air, sustains and equalises a constant circulation, in and along the continuous extent of the two elements, as they embrace and

envelope the whole earth, from the equator to the two opposite poles,*

As far as I have been able to learn, there is also in the velocities of the two currents a correspondence, such as might be expected, assuming both to have the same origin in a general law of nature. For upwards of two thousand miles, the Gulf stream preserves an average rate of three miles an hour, which agrees with my own observation of part, at least, of the Natal current; for in lat. 32 deg. S., after a supposed run of ninety miles by log, the next day's observation of the sun gave the vessel but thirty miles northing,—the loss of sixty miles being due to the rapid rate of the current's course to the southward. As, also, off Charleston, on the coast of North America, the Gulf stream contracts in breadth to sixty or sixty-five miles, so, I have been assured, by reliable authority, that the Natal cur-

* Our planet has two envelopes, of which one is general—the atmosphere—is composed of an elastic fluid, and the other—the sea—is only locally distributed, surrounding, and therefore modifying, the form of the land. These two envelopes of air and sea constitute a natural whole, on which depend the difference of climate on the earth's surface, according to the relative extension of the aqueous and solid parts, the form and aspect of the land, and the direction and elevation of mountain chains. A knowledge of the reciprocal action of air, sea, and land, teaches us that great meteorological phenomena cannot be comprehended, when considered independently of geognostic relations. Meteorology, as well as the geography of plants and animals, has only begun to make actual progress, since the mutual dependence of the phenomena to be investigated has been fully recognized. The word climate has certainly special reference to the character of the atmosphere, but this character is itself dependant on the perpetually concurrent influences of the ocean, which is universally and deeply agitated by currents, having a totally opposite temperature and of radiation from the dry land, which varies in form, color, elevation, and fertility, whether we consider its bare rock portions, or those that are covered with arborescent or herbaceous vegetation.

These two envelopes of the solid surface of our planet—the liquid and the ariform—exhibit, owing to the mobility of their particles, in their currents, and their atmospheric relations, many analogies, combined with the contrasts which arise, from the great difference in the condition of their aggregation and elasticity. The depth of the air and ocean are alike unknown to us. At some places, under the tropics, no bottom has been found with soundings of 276,000 feet (or more than four miles); whilst in the air, if, according to Wollaston, we may assume that it has a limit, from which waves of sound may be reverberated, the phenomena of twilight would incline us to assume a height, at least, nine times as great.—*Cosmos.*

rent, as it proceeds to the southward, exhibits a like tendency, and at sixty or seventy miles from the coast is lost in the surrounding ocean.

Before proceeding further, I wish it to be also noticed, that the marine current here described as so particularly affecting the temperature of Natal, is attributed by the latest writers on the subject, not only to the general movement from east to west in the tropics, called the equatorial current, but also to the continued pressure of the south-east trade winds, on the more southern portion of the Indian Ocean, and as far east as the western coast of Australia. A vast body of water is thus forced between the numerous islands to the north-east of Madagascar, and upon the opposite shores of Africa and Arabia. From this confined position it has no other escape, than by rushing along the coast to the south west, reuniting, about the parallel of Natal, with that portion of the same current which takes a course along the eastern side of Madagascar. I draw attention to this explanation—contained in Keith Johnston's Physical Atlas—for, when attempting to prove that the rainy south-west winds, so prevalent in all seasons at Natal, originates really in the south-east quarter of the horizon, a somewhat similar effect of locality upon direction will be remarked, as arising from the insurmountable obstruction offered to a moving body of air, forced directly against, and upon the elevated slope of the eastern face of the Drakensberg.

Besides these circumstances entering into the constitution, or affecting the character of the climate of Natal, its protected situation from the influence of the great atmospheric currents from the north west, which, during the winter months, prevail on the other side of the continent, must not be forgotten. As regards this frequently tempestuous wind, it may be safely asserted, that it is unknown in Natal, which, occupying the abrupt eastern declivity, is, in nautical language, under the lee of that elevated and gently inclined plateau (the extensive counter-slope of the Drakensberg range), drained by the Orange River, and which is the chief scene of the violence and exhaustion of the north-west wind, almost constantly blowing beyond the limits of the trades, in the South Atlantic Ocean. In fact, it is this sheltered position of Natal from the usual effects of season changes, below, and the presence of the eastern atmospheric current above, flow-

ing into the interior, which preserves an almost invariable, uniform pressure upon the contained mercury, and renders the barometer of little use here, as an indicator of weather approaching.

And, to be properly understood, it is necessary that attention should be called to the effects produced upon the temperature, and direction of currents of air, by the surface configuration of Natal. It is well known that heat is not communicated to the atmosphere by the mere passage of the rays of the sun through it. This is evident from the fact that temperature diminishes considerably with elevation. It is by subsequent radiation and reflection from the earth's surface, that heat is developed, or becomes sensible. Electricity is another somewhat analogous operation, and, it may be, that light itself requires contact with a physical reagent, to produce the effects or phenomena, comprehended in the sub-science, *optics*. Beyond the limits of our atmosphere, it is possible, and not very improbable, that all sensible phenomena cease, connected with material reaction upon solar rays. Another law of solar heat seems to be, that it is the direct rays only falling upon the earth, that exert any calorific influence upon the air. The comparative little warmth which accompanies the rising sun, is thus accounted for. In the early part of day, its beams pass over a succession of localities, in lines parallel to the horizon, and are only intercepted, and actively excited, by surface irregularities, such as hills, or other accidents of situation. Fogs and low clouds, over rivers and in valleys, in this manner receive first impressions, and assist in diffusing warmth, when otherwise the protracted absense of the sun's influence would have a serious effect on vegetation, especially where the labors of man are concerned. As altitude in the heavens is attained, the heat increases, until, at mid-day, the meridian line experiences the full power of the luminary, apart from the superadded accumulation of heat, during the previous and subsequent hours of the day. Keeping these circumstances in view, it will be easily perceived, how singularly effective in collecting and economising the sun's rays, is the peculiar and characteristic features of Natal scenery, and its general surface delineation. Inclined at a considerable angle, it rises from the sea-shore to the summits of the Drakensberg, an elevation of six thousand feet within a distance of one hundred and fifty miles; and, in the southern half

of the colony, even attaining a height of seven thousand feet, within one hundred miles from the coast. Some time before the sun is seen above the horizon, on the sea shore, has it illumined the crest and sides of this elevated and rugged range. And that, too, with the fullest effect, to rouse and develop the latent caloric which accompanies its beams. The highest tops receive in a direct line the earliest rays, the vertical and horizontal relations in such a situation, being reversed to that which exists when the sun is in the zenith, shining upon a level plain. A similar result, but on a grander scale, is in this manner obtained, which is described, and enjoyed in a garden, as the "sunny side" of a wall, with this advantage to Natal, that the Drakensberg forms also an efficient protection against the violence of the north-western gales, which prevail about the polar limits of the southern trades, where the upper current, formed by the ascending heated air, in intertropical countries, flowing on, over all towards the poles, to supply the constant demand below of cooled air, at the equator, first comes in contact with the surface of the earth.* It has been observed by a recent traveller, that the country to the east of the Appalachian range in North America, has a temperature by several degrees higher than the parts in the same latitude to the west of that range—a phenomenon hitherto explained by a reference to its situation being in the same latitudes and to the leeward of the gulf-stream of the north Atlantic ocean, but which, I think, is rather due to the direct heating process going on from early sunrise, as in Natal, by the intercepted rays of light falling upon an elevated incline.

* "The earth being a spherical body, the different parts of its surface must, of course, move with very different degrees of speed. At the extremity of the axis, that is, at the north and south poles, the motion is nothing; while at the point which is furthest from the poles, that is, at the equator, the motion is upwards of 1000 miles an hour, in the latitude of 30 deg. it is about 900 miles an hour. The average velocity of the earth's easterly motion, in the space between the equator, and latitude 30 deg., may be stated at 980 miles an hour, while that of the belt, lying between 30 deg. and 40 deg., is not much above 850 miles an hour.

"Thus it may be seen that the cold air, which flows towards the equator, is influenced by two sources of motion; the first is caused by the heat of the torrid zone producing a partial vacuum, to fill up which the cold air from the temperate zones rushes on towards the equator, and at right angles to it; the second source of motion

Another important element affecting considerably the climate of Natal, to be noticed, is its position with regard to the tropic of Capricorn. It is generally presumed that latitude determines the temperature of a place, and that the heat at the equator is a maximum, which declines proportionately with the distance from it. Observation, however, proves that, as relates to the countries between the tropics, and a contiguous zone beyond, this opinion is not borne out by facts. It appears that, after passing the equinoxes, the sun travels, at different times, with very unequal speed, towards its tropical confines. In the first month it passes through 12 degrees of latitude, and during the second has increased its distance from the equator by 8 deg. additional, but in the third makes no more than $3\frac{1}{2}$ deg., to complete the $23\frac{1}{2}$ deg., whence it ascends again towards the next equinox by similar terms of progression. The consequence is, that tropical countries enjoy considerably more of the solar influence, than those situated immediately under the line, inasmuch as, during two months, the sun is vertical at the solstice, or is inclined at an angle not greater than $3\frac{1}{2}$ deg.; on the other hand, compared with its motion through the heavens when crossing the equinoxes, two places, on which the

is that which has been communicated to it in a direction due east by the rotation of the earth, in the temperate latitudes it has left. The combined effect is to produce the south-east trade wind in south latitude, and the north-east trade on the other side of the equator.

"As every current towards the line must be rendered easterly, so every current from the equator must acquire a contrary tendency, and becomes a westerly wind, because it proceeds from a quick-moving into a slower-moving latitude, and must therefore rotate quicker than the part of the earth on which it arrives. Moreover, as this cause operates least powerfully near the equator, and becomes more powerful in receding therefrom, this would cause the upper tropical current to become more and more westerly, as it advances towards the temperate zones; thus describing the same apparent curve as the trade winds below it, and moving everywhere in a direction exactly opposite to them, a fact which the observations of travellers have established. Again, when this upper current precipitates itself on the earth surface, about the thirtieth parallel of latitude, it has lost but little of its equatorial velocity (because the only friction to which it has been subjected, is that of the lower current), and hence the furious *westerly* gales, which are so prevalent just beyond the limits of the trade winds, or about the thirtieth degree of latitude in each hemisphere, as for example, at Madeira and the Cape of Good Hope."—*The Tempest*.

vertical rays of the sun fall on two successive days, are almost half a degree distant from each other, or, in other words, a country situated on or near the equator, has the sun directly over it for the space of six days only, whilst under the tropics its rays fall nearly perpendicular for two months. Nor must it be forgotten, that the long days, which in Natal are fourteen hours, must affect the mean temperature of the summer considerably more than immediately under the equator, where the days are uniformly of the length of twelve hours. This is partly proved by the fact that the line of perpetual snow is at least 1000 feet higher, in the parallel of $23\frac{1}{2}$ deg., than at the equator, and in latitude 30 deg., under such favorable circumstances as we find in Natal, it is not incompatible, with observations made in similar situations, to suppose that its snow-line would not vary more from that of the equator, than does this latter, from the elevation of the snow line on the tropics. On the southern declivity of the Himalaya mountains, Mr. Webb, a late traveller, found the snow-line, at an elevation of 13,000 feet, corresponding pretty well with its latitude 30 deg.; but on the northern declivity, which is about a degree further north, the snow-line ascends to 16,000 feet, an elevation which corresponds to that found under the equator. On this side, however, the range, though very steep, does not descend to a low country, but terminates in an immense plain, the surface of which is about 10,000 feet from the level of the sea. From this it appears that an elevated plateau, like the Orange river district, has a very considerable greater effect in moderating the extreme cold of its elevated situation, than had the Drakensberg range been broken into mountain peaks, and rose on that side from deep vallies or a low flat country.

Nor must I fail observing, that experience, in all countries, proves there is no cause affecting climate, so constant, or so powerful, as the winds themselves. These constitute the medium through which distant influences operate, and break the stagnant uniformity which would otherwise prevail in many localities, as regards temperature, amount of moisture deposited, and other allied phenomena; or, on the other hand, with equal advantage, moderate the excessiveness of season, an admirable provision, in a benevolent design, to promote man's comfort upon earth. No better illustration of this is required, than that which the climate of

Natal affords. Every circumstance required to secure the most favorable condition of each succeeding season, is there present. Its sloping aspect to the rising sun; its choice of elevations, from the sea side, and its invigorating breezes, to the bracing air of Switzerland; its leeward position, during winter, to the tempestuous north wind; and, again, in summer, still to the leeward of the genial vapours, wafted from over the warm current of the neighbouring ocean. Here the violence of alternating monsoons are unknown. Our equinoctial gales are from the south-west, or the north-east, and are mere squalls compared to the storms in the Indian seas, or on the east and west of the southern promontory of Africa. In winter, Natal enjoys a mild temperature and a clear sky; in summer, the heat of a nearly vertical sun is moderated by intercepting clouds, and the air refreshed by frequent showers. But reverse all the circumstances which give rise to, or affect, the laws that govern atmospheric agencies in Natal. Let the contiguous southern ocean be represented by a large continent, occupying at least a third of its entire extent, like Europe and Asia in the northern hemisphere, and we shall have repeated here the chief features of northern Africa. Like all countries situated within the corresponding parallels of latitude, it would be characterised by extreme aridity, and barrenness of the soil. Over this desert district, would predominate a cold antarctic wind, from the south-east, and not, as now, the westerly winds always prevailing on the edge of the trades, where the normal steadiness of the general currents of the atmosphere is not subverted, by the presence and action, upon air, of an extensively heated surface of the earth, but, aided and sustained by the equitable influence of a large continuous ocean.* Under such circumstances, Natal would be situated, not relatively, as Egypt is to the Sahara desert, which might be imagined, but rather as are

* The new nautical practice of great circle sailing, and the usual route back to England from Australia, by circumnavigating the earth within, or nearly so, the region of westerly winds, depend for success upon the integrity and persistency of air currents, contrasting singularly with the proverbial inconstancy and variableness of the winds in the northern hemisphere, where the great disproportion that land bears to sea, disturbs the operation of general atmospheric laws.

the plains of Nineveh to the sand flood poured over them from the steppes of Tartary, and north-eastern Asia. Natal so situated, backed by the Drakensberg, would, in the course of time, see its rich lands gradually buried ; and, if busy man attempted to rescue from oblivion some small relic of his fatherland, it would only be in the shape of pyramids, as it appears was the resource of the Egyptians ; those wonderful "star-pointing" structures, being now known to be erected upon the summits of hills, of an age anterior to the present era, and which have been enveloped and lost in the drifted sand of the desert to the west. Or, under another less unfavorable aspect, Natal could only be expected to exhibit features of resemblance to the low, rainless district of the Tehama, of the Arabian coast, situated at the foot of a high table land, not unlike, in general character, to the Drakensberg, but without possessing the scanty advantages, yielded by the presence of a large stream, like the Orange River. Nor would this latter, in fact, exist under the circumstances supposed, for without the water supply from a neighboring ocean, necessary to feed river sources, the streamless condition of the Sahara, or of the interior of new Holland, could, of course, only be presumed.

But, without having resource to imaginative situations, we have evidence enough of the agency of winds in forming climate, by reference to parallel existing phenomena upon the surface of the globe, and the explanation given by the best authorities, if applied to Natal, will, I think, be satisfactory to my readers, and useful to myself, as supplying the necessary information, drawn, as usual, from analogy, to account for the striking variations of season, observed upon the different sides of the Drakensberg. In the *Encyclopaedia Britannica*, under the head " America," it is observed :—

" In all regions where ranges of mountains intercept the course of the constant or predominant winds, the country on the windward side of the mountains will be moist, and that on the leeward dry ; and hence parched deserts will generally be found on the west side of countries within the tropics, and on the east side of those beyond them, the prevailing winds in these cases being generally in opposite directions. On this principle, the position of forests in north and south America may be explained. Thus, for example, in the region within the thirtieth parallel, the

moisture swept up by the trade-wind from the Atlantic is precipitated in part upon the mountains of Brazil, which are but low, and so distributed as to extend far into the interior. The portion which remains is at length arrested by the Andes, where it falls down in showers on their summits. The aerial current, now deprived of all the humidity with which it can part, arrives in a state of complete exsiccation at Peru, where, consequently, no rain falls. In the same manner the Ghauts in India, a chain only three or four thousand feet high, intercept the whole moisture of the atmosphere, having copious rains on their windward side; while on the other the weather remains clear and dry. The rains in this case change regularly from the west side to the east, and *vice versâ, with the monsoons.* But in the region of America, beyond the thirtieth parallel, the Andes serve as a screen to intercept the moisture brought by the prevailing winds from the Pacific Ocean: rains are copious on their summits, and in Chili on their *western* declivities; but none falls on the plains to the *eastward*, except occasionally, when the wind blows from the Atlantic."*

Allied to the subject of the winds, and the distribution of air currents, in Natal, is the changes observed in the state of the barometer, and which depend upon the weight and height of the atmospheric column, under different circumstances of season and weather, and let the newly-arrived colonist, for perhaps the first time, know, chiefly upon geographical situation also. In tropical countries, the range is considerably less than when we approach the poles, that is to say, the mercury neither rises so high, or sinks so low, as in other climates. From the tropics, the range gradually increases, being greatest between the 40th and 50th degree of latitude. Beyond this last parallel, the limits of barometrical changes do not materially increase, being nearly the same in the highest northern lati-

* Another illustration is afforded by the fact, that the easterly winds in spring, passing over the chilled plains of Germany, lower the temperature of England considerably during their prevalence, whilst, on the contrary, the warm airs from the south-west raise the thermometer several degrees. The western coasts of Europe, by the operation of the same general cause, are rendered habitable as far north as the 70 deg. N. latitude, whilst, on the eastern shores of Asia, wanting the genial western winds, man has no fixed settlement beyond 56 N. latitude.

tudes that have been reached. In England the mean annual range of the barometer, that is, between the highest and lowest extremes, amounts to about one inch and a-half, affording a wider margin for intermediate degrees or conditions, than it admits of in this colony, where, as far as present experience shows, the variation does not extend but a very little over one inch and a-tenth. Other influences, also affecting the height of the mercury, are so intimately connected with situation, that enumerating them will sufficiently explain the cause that render instruments adapted for the purpose of prognosticating the weather in England, not available for that use in Natal. The first and most general is, of course, the temperature of the atmosphere, occasioning corresponding changes in the weight, or amount of pressure exerted upon the surface of the mercury, contained in the cup of the instrument. The heat of the sun within or near the tropics being nearly the same throughout the year, at the same elevations, the expansion of the atmosphere, and its rotary current, are very equally sustained in these regions throughout the year. Between the poles and 50 deg. of latitude, also, the density and other conditions of the air are comparatively permanent, from the opposite cause of extreme cold, and the steadily sustained force and direction of its agitating winds. Between these atmospheric extremes, the range of the barometer is remarkably increased as we recede from the tropics, the sun's rays striking more and more obliquely, the diminished temperature occasions the air to become gradually denser and heavier, whilst the difference of seasons, between summer's heat and winter's cold, reciprocally act to elevate or depress the mercury, now towards a tropical, and then towards an Arctic tendency, the oscillations between the two requiring a wider index to mark them, than is the case in the other situations described.

Another great cause of the variations of the barometrical column, arises from the varying quantity of vapor contained in the atmosphere. Heat not only rarifies or diminishes the gravity of air, making it sustain a less counterpoise of mercury, but, it also promotes considerably the evaporation of water, the vapor of which, again, is still lighter than air. The consequence is, that a volume of vapory air has a much less specific gravity than the same quantity of dry air, and therefore in serene weather,

a warm current of wind always lowers the barometer; but when, from any cause, vapour becomes condensed in dew or rain, a rise takes place. Again clouds, being an anomalous state of vapor, neither in a perfectly gaseous state, nor yet condensed into water, they have a greater specific gravity for, in this form, an active attraction existing between the constituent particles, they collect in masses, and occupy less space than in the full elastic form. Hence in foggy and cloudy weather, the barometer will often be found to rise, indicating an increased pressure, or weight of atmosphere on the surface of the mercury.*

Winds occasion considerable variation in the height of the barometer. When flowing from regions where the air is warmer, and consequently more rarified, the mercury will be observed to fall, whilst, on the contrary, blowing from over cold damp countries, they are, of course, denser than the air they displace, and a rise in the barometer naturally follows. Storms increase the extent of these indications, as they are only winds operating with greater force, and through a wider sphere. The sudden sinking of the mercury previous to a gale, will therefore be in proportion, according as its origin is in a denser or rarer stratum of the atmosphere, and as its distance is greater or less from the point of observation.

Another influence of local importance, telling upon the barometer, remains to be mentioned. Its range in Natal will be much greater than on an elevated table land, or in a low level country in the same latitude. The density of the atmosphere here is subject to sudden and frequent disturbances, by the rapid descent of cold dense air from the elevated regions of the Drakensberg, upon the lower lands, causing the mercury to rise suddenly, whilst at other times, especially in confined basin-like vallies, the reverse will take place, as there the air becomes greatly rarified, not only by the direct rays of the sun, but from the further reflection of heat from the sides of the mountains.

I could wish that it had been in my power to communicate more definite information upon barometrical phenomena in Natal. At present our knowledge is scanty in the extreme, and my chief reason for directing attention to the

* The specific gravity of vapor, to that of air, is as 10 to 14, whilst the comparative weight of a given quantity of pure air, with that of air saturated with water, is only as 765 to 761.

subject, is to excite some lover of science in each of the towns of Maritzburg, Ladismith, and Harrismith, not only to observe, but to communicate the results to the public. Usual experience in Europe leads us to expect a rise in the barometer during fair weather, and a fall before rain. Violent winds occasion it to fall considerably, rising as the fall subsides. In England, an east or north-east wind carries up the mercury highest. In frost, also, it ascends, and when rising in open weather, cold is expected. When it falls suddenly, much rain generally follows, and when very considerably, a violent hurricane or earthquake. When the barometer is high, very dense and dark clouds pass over without rain; but, when low, it will sometimes rain, with but few appearances of wet weather. Another observation worthy of attention is, that in Europe, when there are two different currents of air (frequently noticed in Natal), if the higher one has a direction from the north, whilst that next the earth's surface is from the south, sometimes rain takes place, although the mercury should stand high; but if, on the contrary, the south wind be highest, and that from the north nearest the earth, it never rains, however low the barometer stands. When the temperature of the air is very great, a fall predicts a thunder-storm. These few facts are introduced here for purposes of comparison, and to direct attention in localities where perhaps some one may be found willing to devote a little time and trouble to a subject upon which, at present, very little certain is known, as relates to the climate, and varying conditions of the atmosphere, in Natal.

I shall now speak of the proper local winds of Natal, apart from those general currents of air we have hitherto been considering. The south-west is most familiar, no doubt, to my readers, as this gusty, rain-bearing wind, alternating at intervals of uncertain duration, with the dry and genial north-east, must have arrested attention, if only by the apparent systematic opposition, with which these winds are arrayed against each other. Of the former, it is necessary in the first place to observe, that its south-west course is purely adventitious, being impressed upon the ordinary south-east sea breezes, rising daily, more or less, on the coast of Natal, by the interior being abruptly elevated from the level of the sea, to six, or even, in some parts of the Drakensberg, to eight thousand feet high. Blowing directly upon this mighty

obstruction, the local sea-breezes, burdened with vapour, are forced against the slope, and suddenly checked in their onward course. Being also confined above, by the pressure of the steadily flowing trades into the interior, at a height where the moving volume of air meets with no impediment, the lower stratum of wind in Natal has no other escape, but along the line of least resistance, which is towards the north-east, or exactly opposite to the direction of the marine current on the coast. The warm air, constantly ascending above this, leaves a partial vacuum, into which, as a south-west wind, the baffled and cooler breezes from the ocean, and the east, rush to supply. In the old colony, more especially the western provinces, a south-west sometimes prevails, but differing very considerably in its character from that observed in Natal. Its assigned period appears to be the close of each dry and rainy season, blowing in gentle gales over the interior, until, as the quaint Kolben remarks, "one or other of the tyrant winds sets in." There can be little doubt, indeed, that the south-west wind of the Cape, is the true sea breeze of its north-west and south-east line of coast, sweeping over an easily inclined plane, and if not interfered with and suppressed at other times by some general current of air, as the south-east or north-west monsoons would certainly be of daily occurrence. But with us the south-west is the most frequent of our local winds: there is no one month in the year in which it may not be expected; and it invariably brings or threatens rain. During the equinoxes it comes with a difference, discharging heavy showers of short duration, and principally towards evening, whilst, in other seasons, it is marked by occasional rains of some days continuance, but seldom exceeding three. By the natives it is called the *rain-bearing* wind, expressive of its particular character, and which distinguishes it from all others in Natal. Its course is the line of coast, and inland, follows the general direction of the successive terrace ridges, as they ascend to the summit of the Drakensberg, but its original source was the vapour-burdened airs that rise from over the neighboring ocean, and determined towards the land by the influence which creates and directs what is known, in all favorably situated maritime countries, as the daily sea breeze. The waters of the ocean are not so suddenly affected by alterations in the temperature, as is the surface of the land. The difference between day and

night is, therefore, sufficient to occasion very considerable alteration in the state of the superincumbent atmosphere, for the land, becoming rapidly heated by the direct action of the sun, reacts upon the air immediately above it. On the contrary, during night, it as quickly parts with heat, and again the air becomes correspondingly affected. The diurnal effect of this is, that the heated and rarified atmosphere ascends, its place being taken by the denser and cooler atmosphere over the sea, which is thus made to blow in a direct current upon the coasts. In islands, therefore, a sea-breeze sets inland on all sides during the day, when no disturbing agency interferes, and is everywhere hailed with pleasure by the inhabitants, as a source of health and comfort. Many intertropical climates, indeed, would be deserted by Europeans, but for the general and invigorating influence of the "the Doctor," as these refreshing airs are generally designated. Again, during the night, the water cools much more slowly than the land. The latter begins, immediately after sunset, to radiate its heat into space, where it becomes lost, unless clouds are present to intercept and reflect it back to the earth. The air, above, soon shares in this diminished temperature, becomes colder and heavier than that over the sea, and, consequently, flows towards and underneath it, and forms the land breeze of the night.*

* The following graphic description of the land and sea breezes is from the pen of the old navigator, Dampier :—

"These sea breezes do commonly rise in the morning about nine o'clock, sometimes sooner, sometimes later; they first approach the shore, so gently as if they were afraid to come near it, and oftentimes they make some faint breathings, and, as if not willing to offend, they make a halt, and seem ready to retire. I have waited many a time both ashore to receive the pleasure, and at sea to take the benefit of it.

"It comes in a fine, small, black curl upon the water, when as all the sea between it, and the shore not yet reached by it, is as smooth and even as glass in comparison; in half-an-hour's time after it has reached the shore it fans pretty briskly, and so increases gradually till twelve o'clock, then it is commonly strongest, and lasts so till two or three a very brisk gale; about twelve at noon it also veers off to sea two or three points, or more in very fair weather; after three o'clock it begins to die away again, and gradually withdraws its force till all is spent, and about five o'clock, sooner or later, according as the weather is, it is lulled asleep, and comes no more till the next morning.

"These winds are as constantly expected as the day, in their

This attempt to connect the south-west wind in Natal, with its proper sea breeze, does not, however, satisfy all the inquiries that may be made upon the subject. For example, it is common experience that, during summer, a light refreshing wind from the eastward and the sea, will, for several days together, set inland with remarkable regularity ; and, like the true sea breeze, its influence is felt to arrive at different hours of the day, varying with distance from the sea coast. Thus, at Mount Moriah, a missionary station near the Umhlanga, in favorable seasons, these genial airs are expected about seven o'clock a.m., and gradually increasing during the day, subside early in the afternoon. At the Rev. Mr. Tyler's station on the Umvoti, twenty miles from the coast, the sea breeze appears about ten a.m. The same is observed to be the case at Entoomenee, the Rev. Mr. Schroeder's station in the Zulu country, situated at least thirty miles in a direct line from the sea. At the farm Outkompst, on the road between Maritzburg and Durban, also distant about thirty miles, but with an elevated ridge intervening, the time of

proper latitudes, and seldom fail but in the wet season. On all coasts of the main, whether in the East or West Indies, or Guinea, they rise in the morning, and withdraw towards the evening, yet capes and headlands have the greatest benefit of them, where they are highest, rise earlier, and blow later. Bays contrarily have the disadvantage, for there they blow but faintly at best, and their continuance is but short. Islands that lie nearest east and west have the benefit of these winds on both sides equally. * * *

" Land breezes are quite the contrary to the sea breezes ; for these blow right from the shore, but the sea breeze right in upon the shore ; and as the sea breezes do blow in the day, and rest in the night, so on the contrary these do blow in the night, and rest in the day, and so they do alternately succeed each other. For when the sea breezes have performed their offices of the day, by breathing on their respective coasts, they in the evening do either withdraw from the coast, or lie down to rest ; then the land winds, whose office is to breathe in the night, moved by the same order of Divine impulse, do rouse out of their private recesses, and gently fan the air till the next morning ; and then their task ends and they leave the stage.

" There can be no proper time set when they do begin in the evening, or when they retire in the morning, for they do not keep to an hour ; but they commonly spring up between six and twelve in the evening, and last till six, eight, or ten in the morning. They do come and go away again earlier or later, according to the weather, the season of the year, or some accidental cause from the land : for on some coasts they do rise earlier, blow fresher, and

approach was found to be about one p.m., but the wind very faint indeed. At Maritzburg, I have been assured that the sea breeze is frequently felt during the summer, blowing directly from over Table Mountain, and possessing the usual recommendations, which in hot weather makes these marine airs so acceptable in the inland districts. It appears, however, to me, that the easterly trade winds of the summer, which in the latitude of Natal blow with great steadiness, sometimes for weeks together, and extend generally over the whole of South Africa, are by casual observers apt to be mistaken for ordinary sea breezes of mere local origin, and of the usual ephemeral duration. The people of Harrismith, and of the Winburg district of the Orange River Free State, participate in the advantages of this agreeable accompaniment of summer, but correctly attribute the continued easterly wind, for days and nights together, to a general movement of the atmosphere, sustained with greater steadiness during that season. Situated at such an elevation so far inland, the real character of these pseudo sea breezes is readily distinguished; being so far separated from presumed local influences, as not to admit of being confounded with the casual and more

remain later than on other coasts. They are called land winds because they blow off shore, contrary to the sea breeze, which way soever the coast lies. Yet I would not be so understood as if these winds are only found to breathe near the shores of any land, and not in the inland parts of such countries remote from the sea; for in my travels I have found them in the very heart of the countries that I have passed through; as, particularly, on the Isthmus of Darien, and the Island of Jamaica, both which places I have travelled over from sea to sea.

"These winds blow off to sea a greater or less distance, according as the coast lies more or less exposed to the sea winds; for in some places we find them brisk three or four leagues off shore, in other places not so many miles, and in some places they scarce peep without the rocks; or if they do sometimes in very fair weather make a sally out a mile or two, they are not lasting, but suddenly vanish away, though yet there are every night as fresh land winds ashore at those places as in any other part of the world."

"Places most remarkable for the fewest or faintest land winds, are those that lie most open to the common trade winds, as the east ends of any islands where the trade winds do blow in upon the shore, or the headlands, or islands, or continents that are open to the sea breeze, especially where the trade wind blows down sideways by the coast; for there such headlands as stretch farthest out to sea are most exposed to winds from the sea, and have the less benefit of the land breezes."

limited meteorological effects of the land, acting upon the neighboring sea. At the same time, there cannot be the least doubt that the unequal diurnal force observed in the easterly winds of Natal, is due to the operation of the usual causes of the proper sea breeze, being impressed upon the normal and stronger current of air, which, when favored by circumstances of season, occasionally overcomes the extraordinary obstacle to its natural full development; the diverting influence of the column of heated air, constantly rising above the warm marine current on the coast of Natal.

There are other remarkable exertions of local influences affecting the eccentric character of the rain-bearing south-west wind, which deserve to be particularly noticed. At Durban, or, more properly speaking, Port Natal, the alternations of high and low water have at all times a greater or less effect upon the condition of the atmosphere over the inner harbor. The superficial area of the bay, as it is called, is calculated to be five square miles, or about 3,200 acres, and at low water, with the exception of a narrow channel to Congella, and the anchorage in front of the Custom-house, it presents an extensive dry surface of yellow sand, which in the day powerfully reflects the heating rays of the sun, with a corresponding effect upon the temperature of the air immediately above it. Evaporation under such circumstances is abundant and rapid, for from the first hour after flood, until low water, the progressive advance in emptying the bay, and exposing its sandy bed, creates a constantly accumulating extent of heating surface in immediate contact with moisture; the action of both in producing vapor, being, more or less intensely excited, as the interval of ebb occurs earlier or later in the day, and affords opportunity for the full power of the sun to be exerted on the spot. This very natural process is, of course, subject to the reaction consequent on the opposite state and condition of the elements chiefly concerned; when the bay is full of water, of a temperature much lower than the heated air above it, and, more especially, when the time of high tide happens just as the sun is declining in the west, the hot and sultry character of the weather is then frequently subjected to a sudden transition. The preceding calm of the day changes at once to a fierce breeze from the south-west, whilst, in the same quarter of the horizon, rises a vast body of dark threat-

ening clouds, which sometimes rolls at courser-like speed towards Durban. As the huge agitated mass advances, its well-defined and wind-torn forward edge, catches up towards it the water of the bay in a continued line of spray, and with similar effect upon the dust and loose dry leaves on the land, which move towards the north-east in exact time with the progressing cloud line above, leaping in little whirlwinds towards the evidently attracting motor, just as in experiments with rubbed amber or sealing-wax, many light substances are made to exhibit similar indications of strong electric excitement.

Another variety of the south-west wind, due to local circumstances connected with the bay, is sometimes observed when high water occurs at, or some short time after noon. Considerable disturbance takes place in the atmosphere on such occasions, to adjust relations between its component elements, which seem, in amount or condition, whether of vapor, or heat, or electricity, to have attained a critical extreme. A bank of clouds rises as usual in the south-west, from the Bay to the mouth of the Umlass. The Bluff-ridge, indeed, seems to be the field of discharge, for sudden, sharp thunder claps, like the reports of artillery, accompany vivid flashes of lightning, darting in this direction. Occasionally, too, the inhabitants of that side of the Bay, and in the neighborhood of Clairmont, experience a shower of large hail stones, fortunately limited to a very narrow space, whilst over the bay and town of Durban, a considerable fall of rain takes place, but the storm seldom lasts an hour, and is followed by a clear sky and serene weather. The explanation of these phenomena appears to be, that the commencement of the adjusting change takes place at an immense elevation, even above the line of perpetual snow, which, I have before stated, there is reason to believe, in Natal is not at a less altitude than 16,000 feet. A line projected perpendicularly from the centre of the field of fallen hail, would point to that situation in the atmosphere from whence, a suddenly condensed volume of vapor to the state of a glacial mass, had dropped by the law of gravity directly downwards, whilst the rush of air from the south-west, to supply the vacuum necessarily occasioned by condensation through so wide a space, would account for the strong breeze in that direction, bearing with it the heavy rain of a region less elevated than where the hail was formed.

The south-west wind, as has been said, originating over the warm marine current on the coast, is of a higher comparative temperature with regard to the surrounding air, and is proportionately burdened with moisture in a state of vapor. Whilst the original temperature is preserved, the transparency of the atmosphere indicates little change in its condition, and the rarified vapory air ascends until it reaches an elevation, where, from diminished pressure, the accompanying heat is lost or dissipated in the increased expansion of its medium.* But mere elevation has not the effect of condensing vapor in the atmosphere, at least no sensible alteration to the eye is produced. Its transparency is unaffected, although it is asserted that the color of the sky is to be attributed to the reflection of the blue ray of light, by the aqueous vapor abounding, in extreme tenuity, in the higher regions of the air. It is also certain that, in clear serene nights, the transmitted flashes of electric light, which, in the southern hemisphere would be called Aurora Australis, is due to the conducting power of vapor, as dry air is as complete a non-conductor as glass or silk. In still and sultry nights, Natal frequently beholds magnificent phenomena connected with this property, as momentarily, in some quarter of the horizon, huge cloud masses, extending over half the heavens, are, as it were, internally lighted up, whilst bright, vivid coruscations of electric fire flash along the extreme borders of each well-defined volume of vapor, with a beautiful and constant succession of effect. It is to the influence of this new element, introduced into our consideration of the subject, electricity, which, in fact, enables us to account satisfactorily for many varieties in the phenomena accompanying the south-west wind, which are observed in different situations, and at different times, in Natal.

The natural tendency of the sea vapors and cool airs on the coast to flow towards the land, especially during the day, being subverted by the more powerful influence of the warm marine current, a constant demand is, as it were,

* It has been demonstrated that the density of the atmosphere diminishes in geometrical, as the altitude increases in arithmetical progression; that is to say, if, at the height of three miles, the air is half as dense, or double the volume it has at the surface of the earth, it will be, at an elevation of six miles, four times rarer, or occupy a space four times as great.

kept up, to lead and direct from off the shores the lower stratum of air over Natal. To supply its place, a corresponding effect is produced upon the atmosphere resting against the steep slope of the Drakensberg, and a continually descending land breeze from the north-west, would seem therefore to be another normal characteristic of air currents in Natal. The combined effect, however, which is produced by the meeting, within the influence of the warm oceanic current, of the two diametrically opposite winds, the south-east trades, and the north-west land breeze, is to neutralise the forces of both; or at least to prevent any predominancy of either in their original character, except under extraordinary circumstances. In the winter, or dry season of Natal, the sun, being north of the equator, carries the southern limits of the trades in our hemisphere, two or three degrees further to the north, than during summer. This appears to favor considerably the fuller development of the north-west land winds setting out towards the sea; whilst at this period, also, the southern trades in the latitude of Natal, blow from nearly due east, and the result of the two air currents meeting, and blending together through the rarifying influence of the warm oceanic stream, is to merge both into a wind from the north-east, called by the natives the fair-weather wind, and which prevails on our coast during the winter months. On the contrary, in summer, when the southern trades have their limits extended, and, with increased power and steadiness, preserve their original direction from the south-east, they encroach with considerable effect upon the domain of the land breeze. The influence of the oceanic stream tells, however, on these impetuous winds. Its volume and temperature being greatly increased, whilst the sun is to the south of the equator, and its general influence promoted by the reflected and radiated heat of the neighboring land, the rude violence of that, which would otherwise be a fierce monsoon season, is broken, and the coast of Natal never witnesses the fearful storms which annually ravage the China seas, and the Bay of Bengal.

Singularly enough, it is inland that the season changes, depending upon the south-east trades, are most visible. As we ascend in elevation, the winds from seaward increase considerably, and in duration are much more permanent than is observed lower down towards the coasts. At Harrismith, and in the Winburg district of the Free State, it

is this which contributes chiefly to form the charming character of the summer in those elevated regions. In Natal, we feel the influence in another, but, considering our circumstances, not in a much less agreeable manner. The first effect produced on the southern trades, as they approach the coast of Africa, is, that the lower stratum is lifted up and diverted in its course, by the rarification due to the communicated heat of the marine current over which it passes. At a certain distance, however, above, variable, uncertain, and liable to be influenced by many circumstances, the moving volume of air gradually assumes its normal character and direction. Sometimes, as I have mentioned before, its influence is felt as presumed sea breezes, even so low as the level of the coast, but generally it may be more strikingly observed by its effect in producing the cloudy skies, and short south-west showers and thunder storms, which daily prevail during summer over some part or other of the eastern slope of the Drakensberg, and mitigate, so agreeably, the otherwise oppressive heat of the day.

The neighborhood of Maritzburg is an excellent situation to mark these changes in summer weather, although, no doubt, there are many other localities in Natal, with equally well-defined topographical features, and which are as well adapted to promote the same useful and interesting study. I first noticed there that persistence of meteorological phenomena, which, more than any other character of season, holds out greater encouragement of success, to the curious inquirer into the constitution of climate. For upwards of forty days, in succession, have I observed the same diurnal changes in atmospheric condition, and which, though varying in intensity or amount, could be easily recognised as depending upon one great influencing cause. This was during the whole of November, and the beginning of December, of the past year, when a steady easterly current in the higher regions of the atmosphere could be easily perceived, and, on the higher lands surrounding the town, was actually felt, as a wind from that direction. More frequently, however, its influence was better seen in the varying states of the weather, as observed in the morning, from that obtaining in the after part of the same day. The former would be bright, warm, with very frequently an unclouded sky, and which would so continue till two or three o'clock, when heavy masses of

cloud would rise in the west and south-west, gradually but rapidly spreading over the whole sky, and that from a direction as if travelling in the very eye of the wind. The regular occurrence of the same phenomena, from the same quarter of the horizon, and at or about the same time daily, is to the inhabitants of Maritzburg a natural and very necessary observation, for, surrounded by high lands on every side, that town occupies a shallow basin-like depression in a former extensive plain, from whence, under present circumstances, the heated atmosphere of the day has no escape, when pressed upon by an upper current of air, blowing strongly and steadily from the east. Nature, "our kindest mother still," has, however, provided a sufficient remedy for the sultry, overpowering, energy-destroying influence of stagnant, heated air, saturated with moisture, and in an electric condition most unfavorable for the healthy functional developments of organic life. In the latter part of the day, when the descending sun throws his rays more obliquely upon the earth, the loss of power is every where matter of common observation; but in Natal, this effect of the sun's position in the sky, is singularly anticipated, in consequence of the steep incline its surface presents. As, on the one hand, its slopes and terraced heights are well adapted to intercept and receive the benefit of the earliest beams of the rising sun, so, on the other, we find that his mid-day potency is very considerably curtailed, by the same circumstance of configuration; and at the hour generally the hottest in other less favored lands, or about two o'clock in the afternoon, the clouds (elsewhere proverbially of evening) are fast rising in the western horizon. Condensation of the vapors of the day attend on the declining heat, when the sun's rays, no longer falling, or only partially so, directly on the earth's surface, pass over, in parallel lines, the strongly marked eastern declivity of the Drakensberg range; reversing, it will be observed, the circumstances of morning's experience, though still with favoring effect for man's comfort and convenience, and calculated to promote his happiness, as the future enlightened and contented occupant of this new land of promise.

The clouds rising in the west, move rapidly underneath the easterly current, and, before the descending recoil of its obstructed volume, pressed against the wall of the Drakensberg. Above it has no escape, the superincum-

bent pressure, and onward rush in the easterly course of the wind, proving an effectual barrier; but below, where friction upon the earth's surface has already retarded the velocity, a yielding resistance is offered in the first place, which soon disappears before the accumulating power of this aërial back or counter current. Under such general circumstances, two very different local conditions of the atmosphere are frequently observed, sufficiently well marked to authorise a suspicion that the cause of the variety is an important element in the formation of our climate. On some occasions, early in the afternoon, a sharp, sudden, and short thunder storm clears the sultry air, or the operation is a more protracted one, being for the remainder of the day, and the early part of the night, a continuous discharge of electric fluid, accompanied with rain. The other specific form of the weather alluded to, is a sky becoming gradually overcast during the day with detached clouds, like large sun-screens ; the mornings being light and clear, the evenings just the reverse, and the nights remarkable for the heavy fall of dew which takes place. The different effects upon the human system, produced by the two kinds of weather, also suggests the operation of some general agent, like electricity, to explain the phenomena observed, for when, on hot sultry days, thunder storms with rain prevail, that peculiar disturbance of the nervous system, best understood by its popular name of "sinkings," affects, in some form or other, almost every individual, whilst, on the other hand, when intervening clouds, from early morn, intercept the heating rays of the sun, and the earth and air are relieved from the consequences of excessive evaporation and electrical excitement, a corresponding buoyancy seems to affect the human spirits, and the cool bracing airs from the east, which always accompany this form of weather, still further contribute to the general improvement of health.

To explain the causes of these differences of atmospheric condition, involve the knowledge of all the laws which direct and govern evaporation, a process of nature that seems to play an important part in adjusting and preserving the balance of electric power between the solid nucleus, and the fluid and ariform envelopes of our planet. For our present purpose, however, curiosity must be satisfied with a few general observations on the subject, sufficient to depict a truthful local sketch, not an elaborate "Cosmos," which

one hand only in a generation is permitted to do with effect. In the first place, then, it may be safely asserted that the source of electricity is the sun, for any part of the earth's surface, when exposed to an extraordinary degree of solar heat, becomes affected and excited in a manner, which betrays itself, by a corresponding commotion or disturbance in the superincumbent atmosphere. We see, under other circumstances, surface water rapidly diminish in quantity, and notice that the vapor ascends or descends, moves in the sky, or rests upon the ground, accordingly as the temperature of the day varies, and, we rightly conclude, this very ordinary observation of action and reaction between the earth and air, water and watery vapor being the operating medium, also depends for its development, upon the heat derived from the sun. It is also observed that these natural processes are subject to sudden and violent disturbances, which are always accompanied by changes in the meteorological conditions (vulgarly, of course, called weather) previously existing. The effects of heat seem to be suspended for the time, and a new agent, equally or more potent, is evidently active, and as the change is accompanied by specific and sensible phenomena, we recognise another power of nature, and call it electricity.*

It seems probable that, apart from the disturbing effects produced by evaporation, the earth and air would preserve a constant electric equilibrium; the adjusting operation being an incessant discharge of an internal current at the north pole, to support a surface circulation, which is concentrated again at the southern, to complete the circuit along the axis centre of the earth. Whether the atmosphere shares generally in this assumed system of terrestrial

* Like heat and light, this subtle element proceeds from the sun. It has its own distinct ray, the violet colored one as separated by the prism, or reflected in the rainbow, and possessing the greatest amount of reflection and refrangibility, is the last in the spectrum, as the red or heating ray is the first.

The green, or illuminating ray, as it is called, is the third, or intermediate one, and together they constitute the compound light, happily enjoyed by the most ignorant amongst us. It is this difference in refrangibility, forming, as it were, a natural order of precedence, that admits of the analysis of a ray of light by the prism, and the different powers of substances acting upon this property, is a principal cause of the variety of colors observed in natural objects.

excitement, or acts merely as an insulating screen, like the glass of a Leyden jar, or the gutta percha surrounding an electric cable, to prevent dispersion in space, has also yet to be determined. It is well known, when pure and dry, to be a perfect non-conductor, and, as an observant natural philosopher has observed, that "from air itself, not the smallest particle of electric matter ever comes; for there is reason to think that air, independent of the substances with which it is impregnated, is unable to furnish an atom of this matter, and it is conjectured that pure air and electricity are actually incapable of uniting." The earth, on the contrary, to proceed with my own subject, is known to be a good conductor, and an inexhaustible reservoir of this subtle agent, whilst water is even a better one, and from its readily assuming a gaseous form, yet retaining this original property, it constitutes the principal vehicle by which influences are conveyed into the atmosphere, foreign to its original constitution; and is the medium through which are displayed the sensible phenomena, attending those exhibitions of electrical disturbances that accompany almost every change of the weather.

The earth, as has been already said, being easily excited by a hot sun; water constituting a good conductor; vapor, in the shape of clouds, a discharging agent; and the atmosphere a complete insulator, we have every condition requisite to form an electric machine on a grand scale. And further, as the neighborhood of Maritzburg is admirably situated for purposes of observation, with frequent opportunities of illustration, questions of meteorological interest, such as we are now considering, may be studied, and as satisfactorily explained, as if examined in the philosopher's closet, or made the subject of exhibition in a popular lecture room. In the first place, it must be understood, that as, in the beds of rivers, deep holes separate so much quiet water from the general rapid current that flows over and above, so the shallow elongated depression occupied by the town lands of Maritzburg, and ascending on every side, forms in the aerial ocean an analogous situation, where the local atmosphere is cut off, as it were, from the general influences that operate and govern climate and weather in Natal. Nor is the neighborhood of Maritzburg singular in this respect, which seems to be a particular surface feature of the geological structure of the colony, and marks its general topography,

as characteristically as do the rounded, easily swelling eminences of the chalk downs in some parts of England, and the stupendous cliffs of mountain lime-stone in others, or the craggy pinnacles that prevail in localities of the transition and plutonic rock formations.

We will now suppose one of the remedies which are employed by nature, to remove vitiated and stagnant air, in situations such as I have described Maritzburg to be, called into active operation. In the night it will have been frequently observed, that suddenly, with a clear sky overhead, a strong wind from the west (or perhaps more generally throughout the colony it will be found to be north-west), will rise and blow with great violence for one, or two, or several hours together, but subsiding at or soon after sunrise. As it sweeps along the surface of the ground, sometimes, in gardens, with destructive effect upon vegetables and young trees, it affords good evidence that the cold, and therefore dense air, in its descent, is obeying the laws of gravity, as water would do, and not an impetus of distant origin, impressed laterally and horizontally, as in the case of general currents; nor yet, as a local wind, made to strike the earth at an angle considerably inclined, which the sudden condensation of vapor will often occasion in the surrounding air. It differs from the recoiling volume of easterly winds before alluded to, although it comes from the same direction; one being the natural product, as it were, the other, merely a consequence of the presence of the Drakensberg range; the former, consisting of cooled and condensed air falling from a considerable elevation by its own weight; the latter, the effect of mechanical resistance obstructing a current in its course, and causing it to return upon itself. It differs also, as it rises in the night, generally disappearing with the sun, and, if it blows during the day, it is with greatly diminished energy; nor does it occur towards the close of a hot day, nor bring with it clouds followed by rain and thunder, as is usual in that condition of the atmosphere, when the westerly wind comes as the under current of an upper, and exactly opposite one. Another marked tendency of the former is to veer to the north-west, whilst the reverse, or towards the south-west, is characteristic of the latter. In many particulars, such as its rising in the night, and blowing directly towards the sea, this westerly wind I am now describing seems to be a true land breeze, but its irregular

and capricious appearance inclines me to question this general character. Closer observation and comparison of its periods of occurrence, with the times of high and low water in the Bay, may throw some light upon its real origin; and enable us, perhaps, to class it correctly as a local wind, consequent upon, and peculiar to, the inland neighborhood of that remarkable feature on the coast of Natal. At all events, the beneficial effects of this westerly breeze, which forces before it in its descent, all the impure and stagnant airs collected in the lowest hollows and vallies, cannot be doubted, and I have, therefore, supposed an instance of its occurrence, as the starting point in my endeavor to explain the two different appearances of the weather I have mentioned before as being so constantly observed, in and about the town of Maritzburg.

In early morning, after one of these thoroughly searching visitations of the westerly breeze during the night, the sky is generally clear and bright, and the atmosphere, though calm and still, feels delightfully cool and refreshing. But with the rising sun a change soon commences. The air, resting upon the surface of the earth, gradually becomes heated as the day advances, and necessarily ascends, carrying with it the vapors of a soil particularly abounding with moisture. And here, a law of evaporation requires to be mentioned, to clear the way before further observation. The capacity of air to take up watery vapor varies with temperature, but at a rate of absorption much greater than the increase of heat received. Thus, if 1, 2, 3 represent regular increments of the latter, 2, 4, 8 may, for purposes of illustration, represent the rate at which vapor is carried off, and it can therefore be readily understood how a slight diminution of temperature, may be followed by a very considerable condensation, and a heavy fall of rain.*

* It is a difficult matter, with the scanty means of reference I possess, to convey a clearer idea of what I mean than in the above manner, although, of course, it must not be understood as applying to the law, an arbitrary rate of progression, comparatively, as arithmetrical and geometrical. Perhaps I may here anticipate rigid criticism by remarking, that the amount of vapor in the air is calculated in inches. Vapor, at the temperature of 212 deg. Farenheit, or the boiling point, being able to overcome the pressure of an equal column of atmosphere, is presumed to equal it in weight, at the rate of $14\frac{2}{3}$ lbs. to the square inch, equal to a column of mer-

So far, the process during the day can be simply and easily explained. The rarified air with its burden of watery vapor continues to ascend, until, in situations like Maritzburg, it has attained an elevation, corresponding at least to that of the surrounding eminences which enclose it on every side. Above the lowest of these, which, in the case indicated, is towards the east, where the town lands overlook the Uys Doorns' Spruit, the ascending column of air would, of course, come in contact with other influences and disturbing agencies when present, from which its sheltered position had previously protected it. This circumscribed atmospheric reservoir is sufficiently close and limited in extent, to admit of diurnal crises in the contained volume of air, and which, in some seasons, occur once in the twenty-four hours with the persistance and regularity of tidal phenomena; and even when interrupted, and their appearance suspended for a time, the causes are so evident, that, when explained, as is usual with real exceptions, they only the more strongly prove the natural law existing, that here governs an oscillation of condition in the atmosphere, which, rising and increasing with the daily sun, as regularly falls back and resumes its original state, as that luminary sinks in the west, and during the night succeeding.

The chief cause of this regular alternation seems to be, that the atmosphere in the Maritzburg basin is isolated from any lateral intrusion of denser air, save and except the western ventilating breeze, and, therefore, the only

cury thirty inches high. Now every degree of the temperature of the air has its point of saturation, and every degree of the temperature of water has also its extreme point of spontaneous evaporation, or that induced by natural causes alone, without being forced by any extraordinary means, such as the direct application of heat, &c. For example, water, at the temperature of eighty deg. F., will evolve vapor sufficient to balance one inch in height of mercury, and no more, the extent of surface of both being the same. At sixty deg. F., it will only be a counterpoise to half-an-inch of mercury, and at thirty deg. F. will not even support one-fifth of an inch. If, therefore, in the day, air becomes saturated with moisture at eighty deg. F., which during summer in Maritzburg frequently occurs, and then, towards night, the temperature should descend to sixty deg. F., a fall of rain, equal to this difference of capacity for sustaining vapor, or half an inch, will necessarily take place, unless some such interference, as the removing agency of the westerly breeze, carries before it the vapor laden air, to discharge it over some other locality.

general movement liable to be excited is one *per se* arising from the rarification produced by solar heat; and as this produces no actual current, unless a neighboring denser air flows underneath, and displaces the lighter mass, it will be readily understood, in the present case, that, although heated air is generally said to ascend, this only means an elongation upwards of its column, and hence it is, that calms in such situations so frequently characterise the hottest days.

Evaporation, also, is especially active where the confined air has no escape from complete saturation, and where the supply of moisture is equal to its capacity; this thirstiness for water being constantly increased by continual accessions of heat during the day. The amount of vapor taken up by the air under such circumstances is enormous. By a calculation made in England, in a much less favorable situation than Maritzburg, 1600 gallons of water were evaporated from an acre of ground in twenty-four hours. It has also been found that air, at the temperature of sixty deg. F., and already containing vapor sufficient to saturate it at forty deg. F., will raise a quarter of a grain every minute, from a surface of six inches, until its *dew point* or of full saturation is reached. During the last six months of the year 1855, and the six first of 1856, from observations taken at Durban, the evaporation from the surface of the ground, for the year, amounted to very little less than 50 inches, equal, approximately, to about 16,000 tons for every superficial mile.*

The yearly amount of evaporation in Maritzburg has yet to be ascertained, but I should not be surprised to find a singular correspondence between it, and the annual fall of rain in the same place, the almost daily adjustment of the rarifying effect of the sun, on the one hand, and of

* The actual observations taken at the gardens of the Durban Agricultural Society were as follows:—

1855.	inches.	1856.	inches.
July . . .	4.688	January . . .	3.621
August . . .	5.064	February . . .	3.516
September . . .	3.955	March . . .	4.489
October . . .	4.231	April . . .	4.284
November . . .	4.084	May . . .	4.139
December . . .	3.910	June . . .	3.881

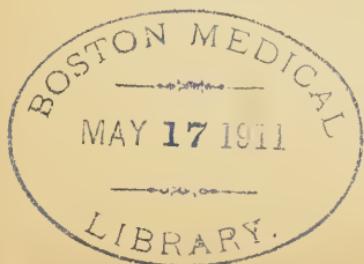
condensation during the cool night, on the other, balancing these operations, or very nearly so.

Evaporation increasing with the sun's power, and the temperature being sufficient to sustain the vapor in an invisible form, it ascends in the calm rarified atmosphere before described, until it meets, at varying elevations, some cold stratum of air, where, of course, a certain portion must be condensed, and either precipitated as rain, or suspended in the form of a cloud; which consists of minute watery particles not brought into actual contact, but adhering to other particles of air, just as drops of water hang from any other solid body. To produce rain, a sudden and complete contact, by a violent effort, such as accompanies electric discharges, seems to be necessary.

The successive arrivals, at the same elevation, of fresh vapor supplies, gradually overspread the sky with clouds, until the point is reached where saturation and diminished temperature are equipoised, beyond which the air, for a certain space, will be clear; but, as it does not lose at once all its burden of moisture, than which it cools much faster, when it has attained sufficient elevation, the decreased temperature again occasions further condensation, and more clouds are produced. And in the same manner several successive strata of clouds and clear air will be formed. Usually the greater the dryness of the lower stratum of air, the further up will the clear region extend, or the higher will be the first region of condensation or cloudiness. In Maritzburg, where the air rests below upon a damp water-abounding soil, it quickly arrives at the point of saturation, and the disposition to precipitate vapor in the form of rain is evinced at a very low elevation, or when very trifling variations in temperature occur. As regularly, therefore, as the day declines, it seems to be a meteorological law of the situation, that this change should be more or less excited, and it must be under extraordinary circumstances indeed, if, that long before sun-set, clouds, or misty vapors, are not collecting about the Zwartkop, and gradually resting upon the highlands to the westward of the town. With the delicacy of a wet and dry bulb thermometer, the smallest decrease of the temperature in the atmospheric pool at the foot of these hills, is indicated by a corresponding descent of mist upon their sides, which, in the dry season, is frequently condensed during the night into heavy refreshing dews,

and also occasionally, indeed, in summer, under the cooling influence of the westerly airs descending from the Drakensberg. More frequently, however, in the latter season, these evening mists hang over the town as a heavy canopy of clouds, which disappear only before the rari-fying influence of the rising sun.

As regards the electric condition of these several strata of clouds, suspended at different elevations in the non-excited atmosphere, the opinions of learned men are various and conflicting, and exact knowledge, therefore, may be said to be nowhere. Some suppose each successive stratum to be relatively, in a negative or positive condition. Others that only the vapor masses floating in opposite air currents are in this antagonistic state, and that these, meeting, lead to those discharges, the accompanying results of which are thunder storms and rain. In an able analysis of the latest discoveries in electricity, contained in the *Edinburgh Review* for July, 1857, I perceive the eminent chemist, Faraday, enunciates a new law which, in future considerations of meteorological phenomena, will have considerable weight in determining opinion. The Professor distinguishes between magnetic bodies and non-magnetic, not from the possession or otherwise of any specific conducting power, but by the difference of direction assumed under excitement. He therefore distributes all material substances into two great classes, "one of which is characterized by having the bodies comprised in it repelled by the poles of a magnet, so that they are constrained to place themselves *equatorially* or transversely to the line, uniting those poles; the other, by having the bodies comprised in it attracted by the poles of a magnet, so that they range themselves *axially*, or in the line uniting the poles." The latter he calls *magnetic*, equivalent to the term *conductor*; and the former, or equatorially arranging bodies, he calls *dia-magnetics*, which of course signifies the opposite, or the *non-conducting* class of the present system. I shall not here enter further into the discussion, than to express an opinion that the electric character or condition of clouds are determined in accordance with this law, by the direction of the air current in which they are carried. An iron bar, placed in the direction of the earth's axis, is well known soon to become magnetic, and it is not too much to presume, that a similar harmony of electric direction is produced upon vapor,



becoming strongly excited or positively charged, as it is borne along by a north or south wind, and, on the contrary, assuming a negative character, or becoming relatively *dia-magnetic*, as it is arranged transversely to the axis of the earth, by being conveyed in an easterly or westerly current of air. Another inference which suggests itself is, that to the same opposite influences may be attributed the different, but definite, general forms and aspects which clouds are well known to assume; the massy heaped up appearance to which the term *cumulus* has been applied, being characteristic of vapor affected by an axial, or north and south wind; whilst the woolly or feathery form called *cirrus*, by the scientific few, or *mares-tail*, by the profane many, may mark the easterly or westerly direction of the air current in which it appears. At all events, long before Professor Faraday's discovery of this new, but which will, certainly, rank as a first law of electricity, I had attributed the different general forms which clouds assume, to some variance in electric condition, such as might be induced by a cause thus pointed out, and if the light it sheds on some obscure questions connected with meteorology, is at present but feeble and unsteady, it promises, at no distant period, or I am much mistaken, a more satisfactory solution of them than the world had previously possessed.

The effect of evaporation in producing clouds, and the causes directing their arrangement in the atmosphere I have alluded to briefly, and, as it were, incidentally, to lead my readers almost unconsciously to form opinions for themselves, and perhaps to tempt some to further inquiry, where observations, numerous and separately made, are so necessary to advance our knowledge of a subject intimately connected with health and the enjoyment of life. But meteorological observers in Maritzburg are not often required to extend their speculations upon clouds beyond a very few hundred feet above their heads. The principal theatre of the weather changes in the environs of that city, is the portion of the atmosphere immediately resting upon and around it. When saturated, or nearly so, with moisture, the result of evaporation, a trifling decline in the temperature of the day immediately produces some degree of condensation, and clouds appear in a previously bright and clear sky. The nearer that perfect saturation has been attained, correspondent to the specific capacity of the temperature of the air to absorb

water, the more sensitive is the atmosphere to any diminution of heat, and accordingly, therefore, the earlier or later in the afternoon will clouds appear under the cooling influence of a declining sun.

Let it be perfectly understood, I am now presuming the circumstance of a calm, still atmosphere, following the occasional night breeze, and also frequently occurring at other times, apart from any consideration of that condition of weather, described as attending upon the recoiling current of the easterly winds of summer. What is termed a *stratus*, in contradistinction to *cumulus* and *cirrus*, now characterise the cloudy masses that towards evening rest over and upon the ground. It is simply a mist, and in its lightest form does not wet any object with which it comes in contact. Its density varies with the hour of the day, disappearing, perhaps for a short time, about noon, and becoming heaviest some time beyond midnight. Occasionally, the accumulation of several days will shut out, locally, the heating influence of the sun upon the earth, and this continuing until the cooled air cannot retain its vapor burden, it assumes the form of a dark cloud, and discharges itself in a shower of drizzling rain, without any, or very trifling, evidences of electric disturbance. Sometimes a faint indication of an horizontal flash of lightning may be observed, but without any noise of explosion: and to detect even this, the spectator must generally be stationed on higher ground, watching for the phenomenon appearing in the valley below.

In some even more confined and isolated situations than Maritzburg, and therefore more favorable for observing this, the simplest meteorological relation existing between the earth, and air, and water, such, for example, as the deep valley of the Sterk Spruit, where it crosses the Maritzburg road to Durban, scarcely a day elapses in the year, that the alterations of condition in the atmosphere, consequent upon the absence or presence of the sun, and dependant upon evaporation for the produced effects, are not both seen and felt; appearing generally towards evening, or else sometime during the night, either as a thick fog or drizzling mist, save when carried away by the strong searching land breeze, that comes really from the west, but, like so much water, takes the general direction of the valley, in its descent towards the sea. And yet, at the distance of barely one mile on either side, the uninformed

traveller would never expect to meet with the remarkable and decided change of weather he is almost sure to experience whilst crossing this narrow and tortuous defile.

It is evident, from the above observations, that little or no electric disturbance is to be expected in the atmosphere, whilst the immediate product of evaporation rests on the soil, from whence the vapor was obtained. The conducting power of the contained moisture preserves a constant correspondence of condition between the earth, and the air immediately above it; and the resolution of the *stratus* will be by simple and direct condensation in dews or light rain, on the reduction of the solar heat, or else it will disappear before the westerly night breeze. When, however, the vapory air is more permanent, it of course becomes, with the earth, negatively charged, whilst other clouds, floating above, become positive by induction, and in this opposed condition, an accumulative crisis being attained, a discharge of some kind or other takes place, either quietly by conduction, if a communication between the clouds and the earth is established by moist air, or attended with a sudden and violent commotion, if a stratum of dry air intervenes between them. Two separate clouds may also become mutually opposed, and frequent successive discharges in this way take place, without danger to life or its pursuits, in the upper regions of the air, accompanied with the most vivid lightning and rolling thunder; the flash and noise of common experimental electric discharges. But a far more dangerous result may be apprehended, when dark heavy masses of positive cloud hang over the negative and exposed earth, should the intervening air be hot and dry. A terrific discharge will frequently, under such circumstances, take place, and the lightning, concentrated on some one spot, will strike the earth with destructive and deadly violence. On some of the plains in the old colony, and Overberg, cases have occurred where several hundred sheep have been killed in one thunder storm; and hunters relate, that they have occasionally come upon the remains of antelopes in such large quantities, within so narrow a compass, as to admit of no other explanation for their death, than from the like fearful cause.

Still it is undeniable that, in this very neighborhood, serious accidents do frequently happen, from the direct descent of lightning on some devoted spot. And it is

generally admitted, that these appalling developments of electrical power, seem to affect some particular locality, a circumstance which naturally suggests the operation of a specific cause, to account for these exceptions to a general rule. On visiting the scene of a dreadful explosion, where four Dutch farmers were killed, and a fifth seriously injured, and which occurred in 1848, not long after the arrival of Lieutenant Governor West in the colony, I was not surprised to learn, from the nature of the situation, that the year before a Kafir and some cattle had been killed in the same manner, and that indeed the place had been abandoned by the natives from the frequency there of dangerous thunder storms. It is the junction of three or four small gullies that, descending on the other side of the town lands of Maritzburg, looking northwards, converge to a common point on the road to York, and form the head of the valley extending to the Umgeni, in the direction of Baines' drift. Here, during a storm, would several local currents of air be led, each charged probably with its maximum of vapor and electric excitement, and meeting together at various angles, some directly opposed, and all obstructive, the eddies of conflict ensuing, would collect and concentrate, perhaps reverse, electric conditions previously existing, and a discharge taking place under these circumstances, would launch, in concentrated form, with destroying effect upon any living creature in its course, a bolt of heaven,—a rapid, vivid stream of light, and fire, and death. In the Zulu country, the respected head of the Norwegian Mission, the Rev. Mr. Schroeder, pointed out to me a situation of a similar character, also marked by a tendency to attract thunder storms, and mentioned the circumstance as one reason which had induced him to remove the station, Entoomenee, to its present site, about four miles to the north and west from where he originally intended it to be.

In two recent instances of death or injury from the effects of lightning, the facts of which I have had an opportunity of learning with some degree of accuracy, it appears to me that, even in the operation of being discharged through a diffusing agency, such as I have described a vapor cloud resting on the earth to be, should unfortunately a mass of some more readily conducting medium form a point of concentrated attraction, the electricity of a considerable area of the surrounding atmos-

phere seems to be determined to it, and whilst the supply is uniform, no doubt is carried off regularly and quietly, but exposed to this danger, that the contents of highly charged clouds brought over the spot in a storm of wind, at an elevation which, under other circumstances, would render them inert, will at once take the direct course of predominating influence through every obstruction, and with all its usual velocity and intensity. In this manner the destruction by lightning in December last, of the house of Mr. Botterill, may be explained, as in the ruins, after the fire, a large quantity of copper wire, which had been placed in one of the rooms, was found to have overcome the diffusive tendency of a rain cloud, neutralized the influence of three ridge conductors of thin zinc, and directed the flash in its course to the earth, being partially fused in consequence. The still more lamentable case, which resulted in the death of Mr. Erich Landsberg, M.L.C., might also be accounted for in a similar way, as the electric fluid was suddenly brought through the room in which he lay by the attraction of several large guns placed together in a corner, and the metal barrels of which, also, were fused and completely destroyed by the intensity of the discharge.

There are, however, some remarkable exertions of electrical excitement, that cannot be explained on the ordinary principles of interpretation, as laid down by men of science, who do not at present seem inclined to attach much weight to opinions that would extend, materially, the laws of communication between the earth and atmosphere. Besides the doubt and conflict of opinion surrounding the *aurora*, it is not at all settled to what is to be attributed the difference exhibited between forked and sheet lightning: and the simple solution that it might be caused by different conditions of electricity, whether as being discharged from the earth to the air, or, *vice versa*, from air to earth, is not received with much favor by the scientific world. At all events, in Natal, the zealous observer of such matters will have ample opportunity of acquiring, and communicating to the world, correct information upon the subject. In this field alone, there is room for two or three reputations to be made: and I shall feel grateful myself for any information which will help to explain some phenomena, the effects of which I have witnessed myself. In the summer of 1855, I was called to attend Mrs. Y., the wife of a respectable

upholsterer in Durban, who had been struck by lightning. On proceeding to the house, I found my patient sensible, but considerably excited by the circumstance, and complaining of some obscure, indescribable sensations in the right side. No external injury was manifest, and an anodyne draught and rest soon allayed all alarming symptoms, though the effects were occasionally felt for some time afterwards. On examining the locality, I was surprised at the eccentric and even capricious course taken by the lightning. At the distance of about nine yards, and at right angles with the door of the house at which Mrs. Y. stood, three seringa trees were growing in a line, about six feet apart, the two outer ones being nine feet, and the centre one scarcely six feet high. Of these trees the lightning struck the shortest only, and from that darted in the direction of Mrs. Y., first striking a granadilla plant that was trained upon the wall. Its course was marked by the usual scathed appearance on the vegetation which lightning produces. The centre seringa tree was killed outright, but the others were uninjured, and the singularity was, that the shortest of the three should have been selected, protected, as it might be supposed to have been, by its taller and larger neighbors. I could see no sufficient explanation for the circumstance, and I note it here as one of those enigmas the Sphinx, nature, has provided, for instructive amusement, and possibly, also, as incentives to enlightened progress, for her favorite—man.

As I see it alleged that the water contained in the human body (and which a humorist in a late *Quarterly Review* puts down, approximately, of course, as a bucketful, with a few ounces of various salts combined) is the cause of the frequent accidents from lightning, by affording a ready means of communication with the earth, I may here remark, that the frame and constitution of Mrs. Y., alluded to, was in many respects not dissimilar to that of my late respected friend, Erich Landsberg. Both evinced considerable tendency to corpulence, and exhibited that plethoric, phlegmatic disposition of body which is generally associated with the popular notion of what is termed a tendency to apoplexy; and which, in a comparative analysis, would, I believe, yield a greater proportionate amount of constituent water, than any other character of human constitution.

During the same season, another remarkable circumstance

connected with electric discharge, was communicated to me by Mr. J. C. Cato. After a short but severe thunder storm, he noticed that an underground cistern, lined with Roman cement, and made at considerable expense, in his garden on the Berea, was rendered useless by some almost imperceptible rent through its sides, which had resulted in consequence of the shocks received from the lightning that had struck the ridge. This is also a curious fact, and worthy of being recorded, as it suggests the cause and origin of the numerous fissures in the recent sandstone of that neighborhood; the various ages of which may be presumed by the different stages observed, in the process of filling up the intervals with segregated quartz.

After my perhaps too frequent digressions, encyclopaediac rather than scientific, in endeavoring to throw light upon the subject of our apparently capricious and complicated weather phenomena, I trust it will now be easily apprehended what important purposes in a providential economy the results of evaporation are made to subserve. Like the benevolent wisdom which, according to the opinion of our most eminent geologists, 'has spread the vast southern ocean, over the field of the most active and extensive volcanic operations of the present era, so a divine consideration for life and its pursuits seems to have provided, in the dispersing properties of watery vapor, an efficient protection for such exposed situations as Maritzburg, from the danger which must always attend upon violent commotions in the atmosphere, accompanied by constant discharges of the electric fluid. In fact, on the first approach of hostile, or oppositely conditioned clouds, from any quarter of the horizon, a screen of vapor is gradually seen to extend a complete shield over these otherwise devoted localities; for where circumstances, such as of arid exposed plains, distant from any sources or supplies of moisture, and where, therefore, evaporation is precluded, the heated surface of the earth, strongly excited by the insulating operation of dry air, only awaits some extraordinary opportunity, that will bring within its sphere of attractive energy an electric charge of an opposite character (for instance, the rain clouds which occasionally reach the interior of the continent), to exhibit in scenes of extensive destruction, such as I have before alluded to, the awful potency of the fiery bolts of heaven, where no provision exists to divert or disperse the threatened stroke.

In its lesser results, we perceive the effect of evaporation in producing those varieties in the daily appearances of the weather, to which I drew attention on entering upon this part of my subject. On the amount of vapor contained in the atmosphere, and its comparative correspondence with the temperature of the air, depends, as before stated, the earlier or later hour at which the afternoon's change commences. Again, when a current of hot air brings, over situations such as Maritzburg has been described to be, clouds charged with electricity, sudden sharp explosions, with vivid forked flashes, and short showers, mark their discharge ; whilst, on the other hand, a colder wind, similarly burdened and relieved, will be accompanied by a continuous rain, more diffused lightning, and distant rolling thunder. As far, also, as present observation goes, the succession of day and night, with season differences, of course, rules and determines the intensity and extent of evaporation ; and, as regards electrical phenomena, so much as they depend on the presence of clouds of distant origin, their character vary respectively, as the latter are either conveyed by easterly winds from over the warm marine current of the coast, or descend on the west, from the cold and elevated regions of the Drakensberg. What I have already advanced, however, will perhaps be sufficient to give an useful general view of weather changes in Maritzburg, and similar situations, and I shall now turn to other considerations, guarding my readers from entertaining any exaggerated impression of the frequency of mists and thunder storms in that neighborhood, merely because I have been obliged to say so much about them, in my endeavor to systemize their occurrence, and reduce their phenomena to some kind of order.

As regards the electrical relations existing between the atmosphere and the human system, and which I note here as a fit opportunity, there can be little doubt that they are intimate and extensive. The changes in many operations of nature, accompanying the discharges of electricity in the air, sufficiently illustrate its influence over analogous operations in the body. Thus a thunder storm will frequently destroy the vital capabilities of eggs ; an observation as old as Aristotle. It will also, as perhaps better known, arrest fermentation, or subvert its results, changing beer and ale rapidly into vinegar. It is a fair inference, therefore, that a suddenly altered condition of the electrical

state of the atmosphere, must affect the many chemical changes constantly taking place in the processes of respiration, digestion, and the conservation generally of the human frame. Especially, also, when it is considered that the mechanical powers of muscular fibre, and the delicate susceptibility of the nervous filaments, have an established organic connection through the agency of electric excitement. Travellers in Siberia have remarked that the frequent electric storms there, have a specific effect in increasing the irritability of the natives, more particularly of the women ; and it is matter of common observation, also, in Natal, that the approach of a thunder storm occasions, in some persons, many very unpleasant symptoms ; and a particular effect upon the system, produced by the African climate (from circumstances more strikingly evinced in the female constitution), I can only attribute to some subtle operation of atmospheric electricity, the evidences of which, with characteristic obscurity, are only discernable in the results produced.

It may not be out of place either, to make sufficiently known those general precautions experience approves of, to avert the too often serious consequences of thunder storms. It is dangerous, for example, within doors, to sit in a current of air, which seems to determine in some measure the course of the lightning. The walls, the fire-places, and windows, should not be approached, especially when ornamented with mirrors or pictures in gilded frames. Wooden floors are better conductors than woollen clothes or feathers, hence persons lying down in the middle of a bedroom are likely to escape. In the open fields, it is found safest to avoid trees, outhouses, fields of growing forage, and also even animals. As in doors, the safest position is to lie down on the ground, and thus present no point of attraction to the electric cloud, as a man would do if walking or riding. But the safest of all situations has been found to be an underground cellar, some three or four feet below the surface. When it thunders, the Emperors of Japan hide themselves in a vault, covered with water, and built as a cistern ; and the Romans, also, we are told, under the like threatening circumstances, used to conceal themselves in caverns, experience having shown them the advantages of that which knowledge now teaches us, to keep at a distance from all bodies by which electricity is attracted, and to retreat as far as possible to

situations either perfectly isolated, and surrounded by non-conducting substances, or else by circumstances favorable for the rapid diffusion of the electric fluid, either in earth or water.

Before concluding my remarks upon the electrical phenomena connected with climate in Natal, which seem to grow with every endeavor I make to restrict them, the curious question as to how far the hitherto uncontrollable elements of the weather are capable of being made subject to man, requires from me the duty of at all events starting it as a subject of useful inquiry. Our daily experience in this colony seems constantly to be suggesting such a triumph of human knowledge, and I feel convinced, but a few years' hence, the wonderful results of scientific attention, and practical application, will mark the realization of meteorological control, which will now, probably, appear not only visionary, but absolutely unreasonable. Let, however, my doubting reader accompany me along the crest of the continued ridge that, commencing at the foot of the Zwart-kop, midway is barred by Fort Napier, and upon its prolongation into the valley of the Bushman's River, Maritzburg is built. In all the high streets, but more especially in Church Street, numerous masses of a compact finely grained iron-stone, may yet be seen protruding through the surface, or fending the angles and curbs of the little bridges that cover the sluits where cross streets meet. At one time they abounded everywhere, but the increase of buildings, and cultivated gardens, and the labors of the Municipality, have contributed to diminish considerably their number, and the nuisances they generally proved to be. But has the question never arisen, to what cause they could be attributed? Frequently, indeed, I have heard them called boulders, but a less appropriate name could not be given them, for I hold they are the production of the spot whereupon they are found, and not the erratic rolled masses of distant rock, to which alone the term boulders can be properly applied. The geological constitution of the ridge consists of a shaly clay stone easily decomposable, the product of an early age, and of a state of nature different from that which at present prevails. Abutting upon this, on its western aspect, is an iron-stone alluvium, as it may be called, somewhat related to the bog iron-stone of marshes in Europe, and which is among the most recent deposits of the present geological era. The extensive

wearing away of the clay-stone ridge, by the joint operation of wind and rain, has reduced it to such a degree, that the deposits in the valley of the little tributary of the Bushman's River to the west, have at length an almost equal height with the older formation, and in fact divides with it the actual site of the town.

The appearance of, and other circumstances connected with this ridge, were, however, very different before it was occupied by the Dutch, Maritzburg properly surveyed, and the water led out in the numerous sluits, that generally, on both sides, follow the direction of the several streets. I have little doubt, that before this momentous arrival, and the changes it occasioned in the physical aspect of the situation, that the ridge was then the scene of frequent electrical discharges in a concentrated form, the large amount of iron disseminated through the soil ardently attracting the subtle fluid, and frequently, by its quantity, overcoming the diffusive tendency of the vapory air, which generally rested upon it. Somewhat like the neutralising effect of compensation magnets on board iron ships, to correct the compass, the effect of the geological constitution of the ridge was to subvert the protecting influence of moist air, and afford to highly charged positive clouds brought over it, the opportunity of exerting their more violent and concentrated form of discharge. And wherever this took place, one result appears to me to have been, to create a disposition in the soil, at the depth of a few feet, to determine towards a centre all the particular constituents, previously diffused through it, and necessary to form those masses of iron-stone, the nature and production of which we are examining. Segregation is a natural process, which fills up, evidently by electrical agency, with different minerals, according to circumstances, those fissures or veins in various kinds of rock, so constantly being met. In sandstone these veins most commonly consist of quartz. In soft, yielding material, like clay, besides the stratifying operation which disposes of the contained extraneous particles of carbon, of lime, and of iron, in horizontal layers, evidences of some extraordinary exertion of a different kind are frequently observed, in a specific deposit forming a hard close-grained crystalized rock, and which could only be the produce of a similar segregating operation to which I have referred in regard to the so-called iron-stone boulders of Maritzburg.

As far, also, as present knowledge extends, they are found only a few feet below the surface (and beyond which, it is known, the effect of lightning does not penetrate), at which they gradually appear as denudation removes the soil above them, where they speedily decompose and crumble away, being followed in succession by fresh crops, as time and circumstances afford opportunity. These, therefore, I look upon as a particular record of the frequent thunder storms that formerly expended their violence on this devoted situation, and when the rule was, what the exceptions now are, besides affording illustrative evidence of the normal intensity of these discharges. Man has effected, I believe, this great and desirable change. Unwittingly, no doubt, but nevertheless, the Dutch farmers, in leading out the head waters of the town river through the streets, in numerous and contiguous sluits, formed an efficient network of aqueous lightning conductors that, affording early and speedy communication with the friendly earth, relieves the contiguous atmosphere of any extraordinary accessions of electricity, and thus prevents any deferred or cumulative crisis, to which the greatest danger seems to attach.

In this manner I have attempted to illustrate the influence over nature man may exert, in the most exposed situations, to protect himself and habitation from the visitation of violent thunder storms, and my next endeavor will be to prove that, by a judicious co-operation throughout the colony, enforced, if necessary, by legislation, the inhabitants of Natal may obviate, in a great measure, the inconveniences and injury so frequently occurring from irregular or extreme seasons, whether of drought or of rain.

It is so evident that the smallest amount of force is sufficient to impart motion to air, that it requires no demonstration here. Further, I presume upon popular knowledge to assert, as unquestionable, that any force acting upon the air from a centre throws it into rotary motion. My younger readers may illustrate this if they please, by taking a common tin funnel, over the wide mouth of which let a sheet of paper be secured. If the interior be now filled with smoke, by burning brown paper at the lesser aperture, slight taps upon the paper will project a succession of wreathed rings of smoke. The same fact may be observed on a larger scale by watching the

firing of cannon on a still day. Whirlwinds and waterspouts are due to the operation of the same rotary tendency of air in motion. The chief cause of these stupendous effects is well known to be the action of heat upon the atmosphere, operating in an extraordinary or accidental manner; in the former case, when some obscure electric relations exists between the earth and air, to disturb the otherwise still and sultry condition of a calm hot day. Frequently, on the dusty roads of Natal, may be seen minor illustrations, in continual little whirls of sand, every where springing up around, which after a few seconds disappear in the atmosphere; and are generally considered to prognosticate rain. On a grander scale, and over the ocean, such electric storms produce waterspouts, and probably, also, the fearful hurricanes of the Indian seas. In the deserts of Arabia and Africa, the same natural phenomenon exhibits itself as a cloud or pillar of sand.* Forty or fifty may be sometimes seen, like tall

* "As they were always harmless, it was an amusing sight to watch these tall pillars of dust, as they rapidly passed by, carrying up every light substance to the height of from one to even three and four hundred feet. The rate at which they travelled varied from five to ten miles in the hour: their form was seldom straight, nor were they quite perpendicular; but uncertain and changing. Whenever they happened to pass over our fire, all the ashes were scattered in an instant, and nothing remained but the heavier sticks and logs. Sometimes they were observed to disappear, and in a minute or two afterwards, to make their reappearance at a distance further on. This occurred whenever they passed over rocky ground, or a surface on which there was no dust, nor other substances sufficiently light to be carried up in the vortex. Sometimes they changed their color according to that of the soil or dust which lay in their march; and when they crossed a track of country where the grass had lately been burnt, they assumed a corresponding blackness."—*Burchell's Travels South Africa*.

In writing my own experience, during a visit to Abyssinia in 1842-3, I observed on one occasion,—"On looking towards the east I saw, with astonishment, the sky in that direction quite dark, with one vast cloud of wind, and the red sand borne up before it. Its rotary motion was very evident, although the whirlwind, as it really was, was too large and too near to be seen distinctly as a separate body, which it might have been at some little distance. It advanced towards the camp at the rate of about ten or twelve miles an hour, but as numbers were now shouting to me to get under cover, and I did not know exactly what effects to anticipate, I made a dive into my hut, and wrapping my head and face up in my handkerchief, to prevent inhaling more of the fine sand than could be avoided, I awaited the result. In a few moments afterwards, the strength of

giants, reaching from earth to heaven, and all moving towards the same quarter of the horizon. They are always indications of rain, and at night, in the same direction, will be observed continued flashes of sheet lightning, the clouds of fire resting over some temporary provision of water, and towards which the thirsty caravans, in the dreary and arid desert, hasten for necessary supplies.

It has also been observed, that accidental causes will produce in the atmosphere similar rotary movements, accompanied by local showers or storms of rain and wind. The scientific periodicals of America abound with recorded instances of sometimes fearful grandeur, resulting from the burning of refuse wood in clearings. One case, related by a Mr. Aikin, was as follows:—“ In the year 1830, I had cut the timber from a small tract of woodland, comprising about twenty-five acres, and the brushwood throughout the field had been piled and prepared for burning. Previous to firing it, the brushwood lying near

the wind passed over us, whirling the roof of my hut, along with the mats covering the salt, high up in the air, and scattering them far and wide over the plain. The heavy stones that had been placed upon them to prevent such an occurrence, being rolled off, sometimes upon the prostrate Kafilah men, who lay under the sides of the salt heaps, which they had hoped would have served as a kind of shielding from the blinding and choking sand. A few drops of rain, and some distant claps of thunder, accompanied this phenomenon. In a few minutes, the sky clearing, the short silence of the camp gave way to a burst of shouting and laughing, as the people chased the retiring column, in pursuit of their flying mats and ropes. I got out of my retreat, and saw moving towards the west, an immense pillar of sand, reaching from earth to heaven, in form and size exactly like the huge waterspouts I have seen out at sea, off the island of Ceylon.

On asking Ohmed Medina respecting these sand spouts, and whether they were common in Adal, he told me, that sometimes twenty or thirty of them might be seen at once upon extensive plains which admitted of their formation, and added, that they were always accompanied by rain, and with sheet lightning in the horizon by night ; and that these signs directed the Bedouins to situations where they would not fail to find water for their flocks. This was a most interesting fact for me to learn, evidently proving, as it does, that the goodness of heaven was not especially devoted to the comfort and happiness of the Israelites alone, as with some little national vanity, and more ignorance of natural phenomena, these people have ascribed the presence of a pillar of cloud by day, and the pillar of fire by night, to be, imagining them to have been solely created for the purpose of directing them in their wanderings through the wilderness.” — *Johnston's Travels in Abyssinia.*

the cutskirts of the field, was moved inwards, in order to prevent the spreading of the fire to the surrounding woodlands ; the materials thus removed forming a circular range or heap around the general mass of combustibles in the area of the field. On a warm and perfectly calm day in the summer, this circle was fired on all sides nearly at the same time. The smoke and flame soon gathered towards the centre of the field, where they whirled and ascended with great rapidity in a single column. With the strength of the whirl the fire rapidly increased, and the heat and flame from opposite sides pressing inwards towards the ascending column, the latter continued its spiral or whirling motion with great rapidity and violence. It was a magnificent spectacle ; and was attended with a loud roaring noise, and a sort of crackling, and nearly continuous thundering, resembling that which I have heard in a violent hail-storm."

Another instance occurred in Massachusetts, on the property of Theodore Dwight, Esq. :—"A quantity of wood had been collected in a field for burning, when a fire broke out accidentally in a forest on a neighboring mountain. As this fire reached the border of the field where the wood had been collected, the owner sent some men to fire the pile, in order that the whole might be consumed together. The weather was mild and serene, and the atmosphere perfectly still. Mr. Dwight was residing at the distance of about half-a-mile from the fire, and his attention was suddenly excited by a loud roaring noise, like that of heavy thunder. On going to the door, he discovered the cause. When the fire became general throughout the field, a whirlwind had formed in the midst of the flames, producing a sublime effect. The flames were collected from every side into a large column, broad at the bottom, but suddenly tapering into a much smaller size, and it stood erect in the field, to the height of probably 150 or 200 feet. It was a pillar of living and most vivid flame, whirling round with astonishing velocity, while from its top proceeded a spire of black smoke, to a height beyond the reach of the eye, and whirling with the same velocity with the column of flame. The noise produced by this whirling was louder than thunder, and being much longer continued, was heard at a greater distance than is commonly the case with thunder. During the whole period of its continuance, the pillar of fire rolled slowly and majes-

tically round the field ; but generally the air was entirely free from both fire and smoke, except what was collected in the column. The spire of smoke, above the pillar of fire, not only whirled round with great rapidity, but, owing to its great height, waved gracefully in the air, adding much to the beauty and splendour of the exhibition”

But whirlwinds and explosions of thunder are not the only accompaniments of these conflagrations. When on a more extensive scale—as, for example, when a prairie of many square leagues in extent, or the large cane brakes of some of the southern states of North America, are fired by hunters or hostile tribes—severe storms of rain and wind are almost a certain consequence. In Europe, some suspicion of a connection between extensive concussions in the atmosphere, and storms almost immediately following, has led observers to note curiously the particular succession, after several great engagements, and large fires in cities, as almost constituting an actual relation of cause and effect. In Natal, it is impossible to quote authority, but I feel satisfied I have met with such an illustrative catalogue of cases, and also believe my readers’ memory will supply any deficiency of corroborative evidence in support of my views I might otherwise have derived from this source. The instance of the severe gale following the battle of Trafalgar, where several large men of war were burnt, if I remember rightly, was the occasion which chiefly directed attention to the subject. However, my experience in Natal of the consequence of firing grass in some conditions of the atmosphere, has led me firmly to believe that, whilst the necessity of the practice continues, and is available, it might be, by being properly ordered and directed, made of invaluable service, in determining the weather to a propitious or seasonable course.

Under existing circumstances, the system of grass-burning in Natal, a rude but universal agricultural operation, has no fixed period for general commencement. Every one, civilized or uncivilized, does that which individual interest dictates or suggests. Under native law, however, it was a capital crime to begin without the word of the great chief permitting it. The reason for such restraint is difficult to obtain : obedience might be considered a territorial homage, but I am also inclined to attribute it to some traditional social policy, based upon similar observations which move me to these remarks. I cannot forget

that, at a very distant period in the history of man, when Ahab reigned over Israel, the prophet Elijah acted, in a season of remarkable drought, with an apparent knowledge of the almost certain effect upon the atmosphere, of a large fire ignited "at the time of the offering of the evening sacrifice;" thus precipitating a meteorological crisis, by something more, I believe, than the mere accidental coincidence of a particular agency, acting at a proper moment, especially as both were deliberately selected by the prophet for his purpose.*

And even as regards the worship of Baal, if indeed the Jewish idol was the Belinus of ancient German mythology, the large bonfires that celebrated the eve of midsummer, throughout all the countries of Europe, would seem to imply an original purpose connected with some great and general national good. Wherever the custom has descended to our own times, under the Roman Catholic guise of honoring St. John the Baptist, to which saint the anniversary was transferred, popular tradition sanctions many acts of idle, but amusing divination, and a superstitious belief prevails among the more ignorant, that happiness and good health, for the rest of the year, are sure to attend upon the religious observance of this relic of heathenism. Priestcraft, as old as original sin, had this advantage in those early days. Man, made in all things excellent and good, and with knowledge intuitive, the relation of cause and effect on many a now obscure problem of natural history, would be then to him clear and distinct; and rapid as may have been the degenerating effects of the fall upon the human race, the best and wisest of the first generation would naturally seek to protect their now exposed and helplessly ignorant children, from the physical evils which, concurrently with the loss of Eden, invaded and ravaged the earth. At all events, the exalted philosophy upon which was based that early social system, the ruins of which we see in castehood, and in the practices and obser-

* (1st Kings, chap. xviii., 31-38.) The incidents connected with the exposure of Gideon's fleece to the night air, under the different circumstances of a clear or cloudy sky, are quite sufficient to prove close observation of nature, and the perfect knowledge of the phenomena connected with the deposition of dew, possessed by this judge over Israel, and is another instance of the real character of many of the hitherto supposed exertions of preternatural or miraculous powers by the Jewish priests and prophets.

vances of now mere forms and ceremonies in many an old religion, or absurd country custom, must have been the result of an enlightened and benevolent experience, such as could only be imagined of in a golden age; and the correspondence between the description of it preserved in ancient classical poetry, and the accounts given of our first parents in Paradise by Moses, is a remarkable coincidence that must have weight in judging the evidence upon which is based the historical fact of the primal excellence of man. In my opinion, few questions of equal importance are open to less dispute or doubt.

Among the intelligent instincts which, in the moral decay of the race, would be the least liable to be soon extinguished, would be those which contributed to preserve the health and physical comfort of individuals. The exiled fathers of Eden would seek to obviate the evils of present situation, and wherever possible apply to the government of their families, those principles of social economy ; or to the improvement of their condition, those useful facts in natural history, a knowledge of which must have accompanied the excellence of their original state. Upon this subject, however, I shall have something more to say when commenting upon the institution and purposes of general fasts as social observances, and which, from forming an important part of an enlightened system of sanitary economy, has been degraded to an almost useless religious ceremony. The means also within the power of man, to control and direct the character of the weather, was, I believe, information of a like primeval origin, for we can scarcely suppose that, that, which even now appears a bold unreasonable presumption, could, not only, have suggested itself, but provided the necessary machinery— involving a sufficient agent, an apt time, and a proper place for its successful operation — during that period of benighted ignorance which is supposed to have commenced at the fall, and from which man is now so slowly emerging. Were I engaged in a research into the early history of our race, I might here enlarge upon the exhaustless store of historic evidence which still exists upon the surface of the earth, apart from any written or inscribed records, and which will be available when further progress, in reproducing circumstances of enlightened wants, and contemplating the means to supply them which science offers, suggests the *rationale* of numerous now forgotten memo-

rials, and discovers the moral purposes which many an otherwise obscure, and even apparently unexplainable, custom or ceremony, was originally intended to subserve. My illustration, which will consist of applying to our experience in Natal, for a definite object, a customary ceremony without meaning in Europe, is all I can here find space for, though, on a subject so curious and interesting, ample materials exist for filling a large volume.

The topographical character of the surface of Natal, and its more peculiar meteorological phenomena, related in connection with the rain-bearing south-west wind, and the laws of the atmosphere generally, have been, I trust, sufficiently impressed upon my readers' mind, to admit of his readily understanding in what manner, by means of large fires, the adjacent and superincumbent air might be influenced and disturbed. It will also be perceived that the effects must be different, as the experiment is made, whether during a calm, or when high winds prevail, and that they will even vary considerably with the direction of the latter; and the systematic character of the daily change in the state of the atmosphere I have described, will suggest another variety of effect, as possibly resulting from fires ignited in the after or fore part of the day, and accordingly, either anticipating, or on the other hand interrupting, the ordinary consequences of successive heat and condensation, which in Natal accompanies, respectively, the morning and afternoon sun.*

* In Dohne's Zulu-Kafir Dictionary, published in Natal as this sheet is going through the press, I find an interesting confirmation of my view of these daily changes in the atmosphere, drawn from the experience of the natives themselves. Illustrating the difficulty of ascertaining the primary sense of compound words, or a clear idea of their construction, Mr. D. takes the instance of the word "imfenza":—

"I received the word "imfenza" with the meaning "wind of the afternoon." The native who explained the word to the inquirer, had obviously referred to the fact that the imfenza is to be observed in the afternoon as in the forenoon, and cannot soon be dried up by wind. What time it has taken, and how many questions I had to put to different natives, in order to find out what this curious word meant, is too much to state here; but it was clear to me that nothing of the meaning affixed to it was to be traced."

Singularly enough, from the opportunities I have had of observing the peculiarities of weather in Natal, I think I am in a situation to affirm, that a mere comprehensive or intellectually formed word "imfenza" could not be instanced, as an illustration of the pro-

Two circumstances remain to be noticed, one being the almost continuous grass covered expanse of the colony—as some would say, “through its length and breadth;” and the other, the contrasting appearance, equally general, that the country exhibits after the annual burnings, either in January or June. Every farmer, English, Dutch, or Kafir, during these months, is as busy with the brand, as in Europe he would be with scythe or sickle, in its season. Each consults his own convenience, or the experience of the wants of his stock, and acts independently, without consultation, or other consideration, to direct a systematic and combined operation. From this cause, it is not unusual to find these individual, and therefore circumscribed burnings, extended until even over the second succeeding month to the ordinary times. The irregularity produces this inconvenience, that a specific effect is produced upon local atmosphere only, and short showers, or light mists, at best, but little available for agricultural purposes. attend upon this partial and temporary artificial heating of the earth. For on the smallest, as on the largest scale, nature is true to herself, and any extraordinary disturbance in the usual relations existing between earth, and air, and water, by the influence of heat, as set forth in my remarks upon evaporation, are followed by indications of electrical excitement, and a disposition in the atmosphere to deposit moisture in some form or other. Often, in my professional visits into the country, have I been the victim of these drizzling mists, which I could easily connect with the occurrence of some grass burning in the neighborhood where I was; and especially if, towards evening, or in the night, the heavens were lighted up by the flames, hovering clouds, as if attracted to the spot, could be then distinctly observed, and rain before morning, or during the next day, might be prognosticated with considerable confidence. Indeed, it was the frequent occurrence of this unpleasant personal result, following upon an evident and

found philosophy which, as a human instinct, seems to direct man in the selection of proper terms to express intelligibly and easily, yet briefly, a collection of connected phenomena. On referring in the dictionary to “finya” and “imfe,” the radical signification of “imfenya” will be found to be, “the condensed moist wind;” and this, being the peculiar characteristic in Natal of the afterpart of the day, would occasion it to be so described by the natives in giving information to Mr. Dohne.

sufficient cause, that first directed my attention to the inquiry we are upon, and convinced me, at all events, of the agent such fires might be made, to determine a fixed and positive character to season, by being properly directed and carried out in accordance with a system of meteorological observations, which, by reference to monthly means, or averages of rain-fall, should determine when, where, and how long, grass-burning, as a national institution, should commence and continue.

For example, we will suppose the average mean rain-fall in Natal has been obtained from observations extending over many years. And this, not only for the year,—for the seasons, wet and dry,—and for each month, but also for the three zones or belts of country it will be useful to divide the colony into, namely, the coast—the middle,—and the upper or burg district, all depending upon situation on the elevated incline between the sea and the Drakensberg. Possessed of this knowledge, and also of the actual amount of the previous rain-fall for the year, comparatively safe conclusions may be made as to what may be expected, especially as a specific character of weather, sustained during half a season, gives some assurance of its persistence for the rest of the term. If already, a proportion, coinciding with the calculated proper mean amount of rain, had fallen, it would, I presume, suggest a cotemporaneous ignition of the grass in all the districts, that no predominance of effect upon the atmosphere should be determined in any one situation, but that the steadiness of the weather, so far preserved, should be as little disturbed as possible. If, however, it was found that considerably less rain had fallen than the standard quantity due at the time, it would be necessary so to order the times and places of burning grass, that the specific effect of heat upon the atmosphere, might be produced under circumstances most favorable for contributing to that meteorological crisis, upon the attainment of which seems to depend electric discharges, and their usual accompaniment of wind and rain. And this, in Natal, is evidently towards evening, when the characteristic tendency of the day's decline to condense the vapory air, creates an apter sphere for igneous agency to produce readily that agitation and excitement in the atmosphere which results in a descent of rain.

But not only the time, but the situations where firing of grass should, as a system, commence, would be another sub-

ject of careful consideration. For beginning in the upper or burg district, and proceeding downwards towards the coast, would have a different effect upon the atmosphere to that produced by the same process carried out in the opposite direction, and I suppose that extreme seasons, whether wet or dry, would require relatively the reverse operations. Thus, when an extraordinary amount of rain has fallen in the first half of the wet season, were the January burnings made general on the coast, and gradually extended towards the Burg, it might perhaps greatly assist in anticipating and dividing over longer times, and a greater space, the otherwise inundating deluges which, in very wet seasons, occur in the lower districts in or about the month of April. Or, on the other hand, should the fall of rain, for the first three months of the wet season, be considerably short of the averaged mean, the grass fires, first ignited in the upper regions of the colony, would be in an advantageous position to assail the too rarified atmosphere, which, at a high elevation, was carrying, over and away from Natal, that burden of moisture which, under ordinary circumstances, would have been deposited below.

Again, in an extremely dry season, a comparative examination in the solstice of June, of the monthly means, with the actual rain-fall in the several zones or belts of country, would determine in which the greatest amount of irregularity existed; and perhaps point to some probable cause which could be met and remedied by precedence being given, to some one or other of the district grass burnings : or on the occasion of an extraordinary extreme everywhere prevailing, a well-timed general conflagration, such as might celebrate the anniversary of a God in heathen times, would, in my opinion, for a certainty, be followed by a meteorological revolution in the atmosphere, and a complete change initiated from the preceding state of drought.

And herein may be perceived the reason of the old system of moveable feasts among the ancient Druids, continued in the Church to our own times, and which depended upon the age and position in the heavens of the moon, proving that the idea of lunar influence upon the weather, is as old as man's first study of the subject ; and also because it admitted of some margin for proper opportunity, to apply ceremonies of practical usefulness in correcting, by some such method and means I have been pointing out, any distressing or inconvenient variation

from the ordinary course or condition of the season. But to follow out, at present, more fully my idea of man's power of control over the elements and the weather, is impossible. It is not a science to start, harnessed and equipped at all points, from the brain of any man. Generations of observers will pass away, and yet much remain to be discovered, before that excellence of knowledge will be regained, which shall restore to him some of the high privileges of his primeval state of enlightenment. It is enough for me to have started the subject. It will arrest attention, and there is that in it which will recommend it to thoughtful minds; for assuredly, if agriculture is studied as a science in Natal, meteorology, and its attendant phenomena, must form a chief and most important matter to be consulted in connection with it. And whether the pot of gold at the foot of the apple tree be found or not, the digging and turning over the ground in search of it will result in useful knowledge; and better health, and more certain crops, will reward the patience and perseverance of the observers.

Of the amount of rain that falls annually in Natal, we have, as yet, very insufficient observations upon which to base conclusions. At Durban, on the sea coast, the results obtained from the observatory in the gardens of the Agricultural Society, for two years, were as follows:—

		rainy in. days.			rainy in. days.
1855.			1856.		
July . . .	3.326	3	July . . .	.187	2
August . . .	3.796	4	August . . .	2.694	7
September . . .	21.509	11	September . . .	3.461	9
October . . .	4.534	9	October . . .	25.007	10
November . . .	2.516	7	November . . .	7.520	8
December . . .	20.824	15	December . . .	3.407	6
1856.			1857.		
January . . .	10.609	12	January . . .	7.295	7
February . . .	5.430	14	February . . .	3.056	8
March . . .	13.618	11	March . . .	6.130	8
April . . .	29.428	10	April . . .	2.740	6
May . . .	.653	1	May . . .	1.250	3
June . . .	.709	2	June . . .	3.650	2
	<hr/>	<hr/>		<hr/>	<hr/>
	116.952			66.397	

If the complaints of planters in the coast districts may be allowed to constitute sufficient grounds upon which to

proceed, the different circumstances of the two years intervening between July, 1855, and June, 1857, may be taken as well representing extreme conditions of the annual amount of rain fall; the total, 117 inches, during the first twelve months, being as considerably in excess of a presumed mean, as the fall during the last term, or 65 inches, was, on the other hand, much below it. At all events, under the circumstances, I shall not pretend to fix arbitrarily the annual mean fall, which can be only satisfactorily established by an average, struck from the careful observations of several years. And after all, it must be remembered, that the mean thus obtained would only apply to the lands immediately adjacent to the coast; as the extremes in elevation to the ridge of the Drakensberg, require, at least, that three-fold division, as separate fields of observation,—of the burg,—the middle,—and the lower zones or belts, to which I have before alluded.

We have the advantage of a similar record kept in Maritzburg, and including the observations of several years, the merit of which is due to Mr. Shepstone, Secretary for Native Affairs, to whose kindness I am indebted for this opportunity of inserting it here:—

Monthly and Annual Amount of Rain.

	1853. inches.	1854. inches.	1855. inches.	1856. inches.	1857. inches.
January		4.289	4.169	6.250	4.335
February		7.524	5.400	2.175	4.425
March		3.289	0.710	11.215	5.210
April		1.565	5.025	13.920	5.210
May		1.232	0.750		.675
June		4.055	0.210	1.120	1.455
July			0.450		.600
August		0.256	1.959	1.370	2.825
September	6.340	1.550	8.630	1.985	1 150
October	4.237	8.424	3.165	6.900	2.400
November	6.732	7.752	3.523	4.240	3.870
December	6.937	10.690	6.850	4.530	3.850
Yearly fall.....		50.676	40.911	53.705	36.005

As a further aid to form an opinion upon the subject of the weather in Maritzburg, and to form comparisons of a similar nature in other districts of the colony, I also subjoin the following table of the number of rainy days

in the months over which the observations of Mr. Shepstone extend :—

Number of days on which Rain fell Monthly.

	1853.	1854.	1855.	1856.	1857.
January		17	13	15	19
February		13	17	9	8
March		10	7	18	10
April		7	8	11	11
May		6	4		2
June		4	1		3
July			4		2
August		2	3	7	8
September	11	6	14	12	4
October	15	12	15	14	8
November	15	14	15	18	13
December	17	17	19	13	9

The comparison of the quantity of rain which falls on the coast, at Durban, and that at Maritzburg, nearly fifty miles inland, and 2,100 feet above the sea, will give some idea of the great difference in atmospheric conditions, determined chiefly by locality, that the colony of Natal exhibits. We have yet to receive information of what is the case in the Klip River and Weenen districts, occupying a still higher region, although, from reliable information, I am inclined to believe, that its amount of annual rain-fall will approximate much nearer to that of the coast, than to the results obtained by observation in Maritzburg. If it should prove so, there can be little doubt that it is owing to the circumstance that the chief influence of the *rain-bearing* south-west wind is confined to the coast, and to a certain distance inland, and that when, in its season, it reaches the upper parts of the colony, it has been in a great measure disburdened of its moisture. Under these circumstances, the idea of particular zones of weather suggests itself (to which subject I shall return again), and the advantage in consequence of taking particular averages, in accordance with such a division, rather than a general one to fix the mean yearly fall of rain in the colony, which, beyond being a mere total, would serve no useful purpose, and, abroad, might lead to very erroneous and mischievous conclusions.

Exactly opposite, both in direction and specific character, the north east, or *fair weather* wind, of the natives,

presents many points of contrast with the *rain-bearing* south-west. In the first place, it may be called a general, or season wind, as it prevails during the dry months of the year, from April to September. Inland its tendency seems to be to draw considerably more round to the eastward—the result, I am inclined to believe, of the gradual elevation of the country—the observer, as he ascends, becoming more and more exposed to the proper direction of the southern trades in the latitudes of Natal, uninfluenced, as it is below, by the general direction of the coast, and the presence of the warm marine current in the same situation.

It is worthy of further observation, that although very irregular in the times of appearance and duration, as the dry season advances, the influence of the north-east wind becomes more decided, and its effect in suspending, or partially subverting local peculiarities of weather, is striking and interesting. Diurnal condensation, for example, instead of commencing, as in summer, early in the afternoon, during the dry months of the year seldom exhibits its phenomena until two or three hours before sunrise, when, after a previously clear night, the earth, and more especially its vegetation, becomes covered with a refreshing and copious dew-fall. This is occasioned by the temperature of the atmosphere having fallen sufficiently low to relieve it of, at this season, its comparative scant burden of moisture; for it is only at the coldest part of the night, just before dawn, that the dew-point is reached, as the quantity of vapor contained is only sufficient to saturate air at a very low temperature. The rising sun, however, almost immediately returns to the thirsty air the moisture it had so reluctantly yielded up, and the newly shed dew, again exhaled, rises in the form of large fleecy looking clouds, which creep slowly along the vallies, or rise upon the sides of the hills, and gradually disappear as the day advances. The contrast is certainly striking between the phenomena of evaporation, as observed during the opposite seasons, of the south-west and north-east winds, and the study will increase in interest, as we become more and more familiar with the advantages to man, which seem so singularly interwoven with all nature in Natal. We have seen, at least I have endeavored to show, what an efficient *paratonnerre*, in exposed situations, the exhalations from the earth are made to constitute in one part of the year,

whilst, under the circumstances at present being considered, the clouds produced by the evaporation of the dew, frequently during the day, extend large sun screens between the earth and a hot sun, and contribute not a little to the delightful weather we enjoy in our dry and winter months.

It is usual to attribute the configuration of the southern part of Africa to the same general causes which have produced a like pointed extremity to so many peninsulas on the northern half of the globe, and of which the most marked and best known is India. I refer particularly to this instance, because the direction and alternation of the periodical winds on its eastern and western coasts, correspond so exactly with what is observed in South Africa, and which has led to the conclusion that the coast lines in both situations have been determined in the course of ages by the denudating influence of the prevailing currents of air, alternately from the north-east, or the south-west, according to the season. The effects of large tracts of lands upon currents of air, of course, must be admitted. And there can be no question, that as in India, during our midsummer, the direct rays of the sun, falling on the African continent, renders the land much hotter than the adjoining ocean ; and, as a consequence, a season wind, in some respects analogous to the daily sea breezes, sets in towards the coast, from the direction of which it receives a westerly course, and may very properly be called a south-west monsoon. As the sun moves northward, its influence upon South Africa becoming daily weaker, the easterly blowing trades gain the ascendancy, but being also affected by the run of the coast line, the opposite, or north-east, monsoon is produced, and which prevails on the coast of Natal during the dry season, from April to September.

These remarks, however, only apply strictly to the coast itself, and even there the exact observation of curious or interested minds, can only after considerable doubt feel satisfied, that the normal character of the season winds admit of such systematic arrangement. Inland, the modifications of original direction are intricate and incessant, owing, on the one hand, to the local influence of the warm marine current, and, on the other, generally, to the effect on the permanent trades, of the wide expanse of the Indian Ocean to the south and east. Natal, also, being situated exactly on the debatable ground between the tro-

pical and temperate zones, is still further exposed to constant variations in weather, and ever-changing meteorological influences, arising from the frequent contests for supremacy between the descending upper current of air, flowing from the equator, which first strikes the earth about the 30th deg. of latitude, and the ordinary season winds of the lower portion of the atmosphere.

All these circumstances are alluded to, because, in accounting for the singular character of the great natural viaduct which extends in Natal from the sea coast to the summits of the Drakensberg, it can only be explained by a reference to the similar results produced by these contending winds upon its surface geography. It would almost seem as if this convenient roadway had been built up by the denuding influence, on the one hand, of cold moist winds from the south-west, and the constructive agency, on the other, of the genial north-east, bringing again together, in a drift line, the detached particles of the previous operation ; in fact the two winds effecting, at the bottom of the aerial ocean, what is observed to be the constant result of two opposite marine currents, the deposit of a sand bank or bar along the line of equal forces. I do not assert that the unmistakable evidence of this in a continuous formation of recent sand-stone exists at all, although, in another part of my subject, I may perhaps point out evidences, to some extent, of this, where deep ravines and extensive hollows have been filled up with allied or analogous rocks, and which seem to connect denuded table lands of the old red sand-stone, the basis rock of the colony, in one grand incline of an almost equal gradant throughout its course ; and being a feature of such consistent regularity it can only be attributed, I think, to some such general operation of nature which I have here feebly attempted to indicate.

One other particular current of air now only remains to be considered. This is called by the natives "*the house-burning wind.*" It blows almost directly from the north, and evidently comes from the interior, most probably from over the low, level, and extensive district drained by the river Zambezi,* after having been precipitated from the

* "The falls are bounded on three sides by ridges 300 or 400 feet in height, which are covered with forest, with the red soil appearing among the trees. When about half-a-mile from the falls, I left the

highlands through the extraordinary cavernous fissure discovered by Dr. Livingstone in his late journey across the continent, from west to east. It is a hot, dry wind, characterised by everything which describes atmospheric currents which occasionally proceed from the centre, towards every part of the circumference of Africa. The *harmattan*, of the coast of Guinea, the *kamsin*, of Egypt, and the *simoon*, of Nubia and Sennaar, are its representatives in these countries. All have the usual tendency of heated air to assume a rotary motion in their course, on any extraordinary disturbance in electric condition, occasioned by passing over ground of different constitutions, as regards geological structure, temperature, or supplies of moisture. Thus the *sirocco* of Italy, and the *solano* of Spain, are gusts of hot air from over Africa, tempered and moderated by passing over the Mediterranean Sea; and so, in Natal, the noxious *house-burning* wind, dreaded by the natives around Delgoa Bay, has lost its greatest intensity by reaching a country and climate favorable for its absorbing a sufficiency of vapor to correct the chief cause of its mischievous character. The excessive dryness of this wind, and its aptness to assume an agitated whirling motion, occasions its descriptive name, for the former property so completely desiccates the grass huts of the natives, and

canoe by which we had come down thus far, and embarked in a lighter one, with men well acquainted with the rapids, who, by passing down the centre of the stream in the eddies and still places caused by many jutting rocks, brought me to an island situated in the middle of the river, and on the edge of the lip over which the water rolls. In coming hither, there was danger of being swept down by the streams which rushed along on each side of the island; but the river was now low, and we sailed where it is totally impossible to go when the water is high. But though we had reached the island, and were within a few yards from the spot, a view from which would solve the whole problem, I believe that no one could perceive where the vast body of water went; it seemed to lose itself in the earth, the opposite lip of the fissure into which it disappeared, being only eighty feet distant. At least I did not comprehend it until, creeping with awe to the verge, I peered down into a large rent which had been made from bank to bank of the broad Zambesi, and saw that a stream of a thousand yards broad, leaped down a hundred feet, and then became suddenly compressed into a space of fifteen or twenty yards. The entire falls are simply a crack made in a hard basaltic rock from the right to the left bank of the Zambesi, and then prolonged from the left bank away through thirty or forty miles of hills."—*Livingstone's Travels*.

the latter, suddenly and unlooked for, acting upon the loose materials of their little fires, frequently lead to the combustion of these frail tenements. It is not a little singular that, according to the French traveller, Adanson, a very similar wind from the interior should, on the western coast of Africa, have obtained a like characteristic name, "its most common effect is to suffocate, by its heat, those it immediately envelopes; it sometimes sets fire to their hamlets of straw: they had the experience of many instances of people to whom such accidents had happened, and thereby lost their lives." The non-applicability of the name *house-burning* wind, to the circumstances observed in connection with it in Natal, leads me to suppose, indeed, that this name had its origin in another country, where its appropriateness could be perceived, and that it has been introduced with the negro emigrants from the interior, who, under the name of Kafirs, have gradually spread themselves from Delagoa to Algoa Bay, and, but for the timely arrival of the Portuguese in the course of the sixteenth century, would probably, with the exception of a few Bushmen, by this time have completely extirpated the Hottentot aborigines of the coast of South Eastern Africa.

Fortunately for us in Natal, we only occasionally experience extraordinary visits of this *house-burning* wind, and then for a short time, and when nearly exhausted of its most malignant characteristics. To me it seems an anomaly altogether that this hot wind should reach us at all. Instead of ascending upwards, according to its presumed rarity, and diminished specific gravity, we find it reversing this natural law, intruding upon colder localities, and displacing air much denser, and therefore heavier, than itself. Electrical attraction, in my opinion, can only explain the phenomena, and the influence of the waters of the ocean, in one state, acting upon a large volume of air, in the opposite, may be received as the cause, until, at least, one more reasonable is suggested. In Egypt, in Guinea, and in the northern states of Africa, its effects upon the human system are most serious, respiration becoming difficult, and even painful, and excessive languor and depression of spirits, marking a general influenza prevalent in these countries during its occurrence. Even in Natal, when this hot north wind has prevailed, for a short time only, patients have told me they felt it occasioned the

same rheumatic kind of pains which in England had usually accompanied an east wind there. I am also inclined to attribute some influence to it in producing the well known malignant influenza among horses, which, in the upper and coast districts, annually destroys so many. My chief reason is, that the middle zone or belt of the colony is popularly admitted to be the most healthy, and best adapted for rearing these useful animals; and as I shall show hereafter that the characteristic peculiarity of this district is the remarkable humidity of its atmosphere, this suggests that the hot and dry north wind, with its, in my opinion, adverse electric condition, has been remedied and corrected by being brought into contact with a volume of air exactly the reverse. And this reason seems further confirmed by the fact of the horse sickness being most prevalent in January and February, the season in which this hot north wind chiefly occurs.

One remarkable phenomenon always attendant upon this wind in Natal must not be left unnoticed. I have mentioned before how singularly clouds from the west seemed to advance in direct opposition to a steadily blowing easterly wind, and it is matter of the commonest observation that the hot wind from the north conjures up, as it were, in exactly the opposite quarter of the horizon, a large conical-formed cloud, which gradually increasing in elevation, and enlarging its base, before nightfall completely overspreads the sky. With a feeling something akin to awe, have I watched in certain expectation for the appearance of this spirit of the wind, which lifts itself from the earth, after a manner not dissimilar to the description given of the approach of some demon genius in the Arabian Nights' tales; nor is it, I think, unlikely that a somewhat similar natural feature of the climate suggested the idea to the romance composers of that country. The Kafirs, who seem to be great weather observers (and certainly the profession among them of the rain-maker implies a considerable amount of experience on the subject), are aware of the connection of the cloud in the south with the occurrence of a hot north wind, and a boy in my service, on one occasion sagely prognosticating cold weather to follow, I determined to observe the varying temperature of the days over which the influence of a north wind, and the alleged reaction, might be safely affirmed to extend. Wednesday, Thursday, Friday, and Saturday, the 17th, 18th, 19th, and 20th of February,

in the present year, afforded me the desired opportunity ; and although one observation, under ordinary circumstances, would be quite insufficient to base a safe conclusion upon, I am inclined in this instance to consider the law sufficiently established, that a very considerable decline in the temperature is sure to follow immediately after the occurrence of a hot current of air from the north, and exactly proportionate to its intensity and duration. On the days mentioned, from a maximum of 69.5 deg. F., on the 17th, as shown by a self-registering thermometer, it rose to 93 deg. on the 20th, when it fell during that afternoon to 62 deg., accompanied with the usual phenomena of condensation, and a very cold wind from the south-west; a condition of the weather which continued for several days, and fully confirming the prediction of my native informant.*

Of course, as this hot wind may be expected to occur in every month of the year, the highest and lowest readings of the thermometer during its duration will be affected by the general temperature of the season. Thus in January, on these occasions, the heat may rise to 94 deg., and on the other hand fall to 54 deg., the range being 40 deg., while in the opposite season, during September, the temperature of a hot wind may reach 92 deg., followed by a reading of 42 deg. showing a difference, in a very few hours, of no less than 50 deg. of temperature, and this, let it be understood, marking, not a temporary crisis, such as the hottest

* *Readings of the Thermometers (self-registering) at the Bishop's Station, near Maritzburg.*

					min.	max.
Feb.	17.	.	.	.	62	69.5
"	18.	.	:	:	67	85
"	19.	.	.	:	69.8	91
"	20.	.	.	.	60	93

Dr. Mann, to whose kindness I was indebted for the above record, also adds in a note :—

" These readings are from *self-registering* standard instruments, therefore the time is not recorded; but the hour of highest temperature was pretty nearly 2 p.m. The readings at 3 p.m. were—

Feb.	17.	.	.	.	75
"	18.	.	:	:	84
"	19.	.	.	.	76.5
"	20.	.	.	.	62

" The temperature is pretty evenly at the lowest from 3 a.m. till near sun-rise."

or coldest part of the twenty-four hours, but a decided, and sometimes a permanent change in the state of the weather.

In the course of my remarks upon the general currents of air, I have had occasion to anticipate a very necessary observation as regards the surface geography of the colony; but to enable my readers to realize fully, all and singular the numerous advantages offered by variety of climate in Natal, this deserves a more particular mention. Like the hanging gardens of Babylon (but provided for a nation, not the selfish indulgence of a king), a succession of extensive terraces, each possessing its own peculiarities of climate, offer ample opportunity of selection—from the bracing invigorating character of Alpine airs, to the genial sunshine and mild sea breezes of Mediterranean countries. Between the two extremes of situation, on the coast and in the upper districts, under the Drakensberg, it may be safely asserted, that as great a difference, in the conditions of season and weather, exist, as between Edinburgh and Alexandria, whilst, in the intermediate region or zone, specific meteorological peculiarities distinguish it, quite as greatly from the other two. The latter, from the circumstance of the heavy mists so frequently enveloping the summits of its table-topped hills, and the crests of the numerous kloofs which traverse its extent, has been called the district of fogs; and I have been informed that, in the Klip River and Weenen divisions, it is not an unusual spectacle, at early morn, to overlook towards the east, a vast sea of clouds. It would seem as if, under ordinary circumstances, the vapor burdened, heated air, from over the neighboring ocean, here first felt the effects of elevation in cooling and condensing its volume into a stratum of clouds, beyond which, for a considerable altitude—but depending, of course, upon season—the atmosphere would be comparatively clear and dry. All the district drained by the tributaries in the early course of the Umgeni, as also of the rivers Umvoti and Umcomas, would describe this region of clouds, and in which the weather phenomena detailed in speaking of the south-west wind, as observed in Maritzburg, would generally apply. Observations on the subject are as yet few and imperfect, but I think it indisputable that the number of rainy days in the year, occurring in that city, is at least twice as many as of those recorded in the garden of the Agricultural Society

at Durban, and the difference in this respect, owing to circumstances of situation, and its effect upon the moisture brought from seaward, which here reaches an altitude the most favorable for condensation, will probably be still more marked, when opportunity is afforded of comparing the same with the number of days on which rain is observed to fall in the upper districts of the colony.

Of the sensitiveness of vapor to influences depending upon elevation, an admirable illustration is afforded in the character of the clouds sometimes observed to form around the summit of Table Mountain, Cape Town, and popularly known as the "Table cloth." A constant descent in whirling cataracts of mist seem suddenly arrested upon a well defined line some distance down the mural face of the mountain, and below this the atmosphere appears perfectly clear; a phenomenon attributed to the different temperature of the air. Precipitated by its gravity from a cold into a warmer stratum, the falling moisture immediately reassumes its form of vapor, and disappears in an ascending current, to supply, in a circle, the downward expenditure of the previous condensing process.

The differences in thermometrical observations taken in the three several zones of varying elevation, would, however, best illustrate the real character of climate in each; but as I do not possess any for the upper or higher district, I must content myself by drawing attention to the following table of the mean monthly heat, as observed in Maritzburg during the years 1854 to 1856, inclusive:—

Thermometer—External Mean Temperature.

MONTHS.	1854.			1855.			1856.		
	9 a.m. deg.	3 p.m. deg.	9 p.m. deg.	9 a.m. deg.	3 p.m. deg.	9 p.m. deg.	9 a.m. deg.	3 p.m. deg.	9 p.m. deg.
January	71.5	73.5	66	70	75.5	68	74	84	72.5
February	75	78	69	72	79	71	74.5	80.5	71.5
March	69.5	73	66.5	68	80.5	69.5	71	78.	69
April	66	72.5	62.5	64	75	62.5	64.5	76.5	63.5
May	58	66.5	56	52.5	66	52	55.5	71	51
June	50	63	53	59	68.5	50	50	70	46.5
July	50	65.5	53	45	64	47	51	66	55
August	53.5	67.5	45	54.5	69	56	58.5	69.5	55
September	59	69.5	58.5	62.5	68	55	62	75	59.5
October	65	73.5	62.5	67	70.5	60	65	75	60.5
November	69.5	75	67.5	72	78	67	67.5	74	62.5
December	69.5	76	66.5				70	79.5	67

The daily details upon which have been based the above monthly means of temperature in Maritzburg, are not available for insertion, and as, therefore, to the ordinary reader, they will be almost useless, I shall insert another table of the highest and lowest readings of the thermometer, for twelve consecutive months, observed at the same place in the years 1853-54:—

Thermometer—external, in the shade.

	9 a.m.		3 p.m.		9 p.m.		monthly range
	highest reading	lowest reading	highest reading	lowest reading	highest reading	lowest reading	
1853.							
October . .	82	52	90.5	50.5	80	48.5	42
November . .	78.5	57	91.5	55	78.5	50.5	41
December . .	88	58	94	62.5	72	55	39
1854.							
January . .	90	60.5	94	63	75	59.5	34.5
February . .	82.5	64.5	90	62	75.5	62	28
March . .	85	59	81	57	76	57	28
April . .	74	59	85.5	61	72	55	30.5
May . .	68	44	76.5	60.5	67.5	46	30.5
June . .	62	42.5	74	43.5	61	43	32.5
July . .	62	39	75	58	65.5	45	30
August . .	66	42	84	49	69.5	45	39
September . .	72	49	88	52	80	49	39

From this table it would appear that in the months of February and March the daily temperature approaches most nearly a mean standard of greatest annual heat, and which might be set down, approximately, as 81 deg. F.; whilst the opposite mean of the lowest temperature of the year, over a series, as indicated during the winter months of June, July, and August, might be assumed to be about 44 or 45 deg. F. Let it always be kept in mind that these calculations apply only to a climatic zone or belt of country, corresponding in elevation, or thereabouts, to that of Maritzburg, and that I advance them as mere conclusions I have formed for my own satisfaction, when thinking upon the subject. One other observation, however, may also as well be added here, on the same terms of value, as being derived from a solitary record—the range of the thermometer during the year 1854, and which will be found to be as much as 55 deg. between the highest reading in the month of January, 94 deg. at 3 p.m., and the lowest in July, 39 deg., observed at 9 a.m.

For purposes of comparison, I also append the record of a self-registering thermometer at Durban, extending from over the last six months of 1855, to the first six of 1857, taken from Cullingworth's Almanacs for 1856-57. It may serve also as an illustration of the scanty opportunities we possess at present to draw any definite or correct conclusions upon the subject of the annual mean temperature of the colony generally. The column of monthly means is an approximate calculation I have myself added, to form an idea of what might be the case, and not by any means to fix a reliable standard.

Self-registering Thermometer—examined at 9 a.m.

		min. in shade.		max. in shade.		mean tempera- ture
		highest reading	lowest reading	highest reading	lowest reading	
1855.						
July	.	55	44	83	61	61.5
August	.	62	46	80	66	63.5
September	.	63	45	80	65	63.25
October	.	67	55	86	72	68.5
November	.	70	57	91	69	71.75
December	.	71	59	94	74	74.5
1856.						
January	.	78	64	98	80	80
February	.	85	61	91	75	78
March	.	74	61	91	78	76
April	.	69	56	86	69	70
May	.	64	48	86	69	66.75
June	.	57	45	79	67	62
July	.	58	43	82	66	60.75
August	.	61	47	84	65.5	64.25
September	.	64	49	10.8	66	71.75
October	.	67	54	88	69	69.5
November	.	68	56	93	78	71.25
December	.	70	58	93	78	74.75
1857.						
January	.	74	60	94	77	76.25
February	.	70	56	87	80	73.25
March	.	71	58	91	73	73.25
April	.	69	52	88	73	70.5
May	.	64	52	92	74	70.75
June	.	60	44	83	71	94.5

Having so far endeavored, to the best of the opportunities afforded me, to direct attention to the most striking meteorological phenomena connected with the climate of Natal, the duty of every earnest man, favorably situated,

and willing to forward the general weal of his neighbors, is to lend himself to my purposes, and occupy the leisure hours of country pursuits by noticing, recording, and communicating the results of his observation, upon a subject, the correct knowledge of which involves so much, not only of personal health, but agricultural success. My chief fear in what I have so far written is, that distant readers will perhaps form exaggerated ideas of the vicissitudes of climate in Natal, from the lengthy, perhaps some may think labored, remarks I have considered it necessary to make when explaining my particular views as to the causes of these changes. I therefore conclude this section of my work, by stating, in a few words here, that, unlike most other African countries, the climate of Natal cannot properly be said to have such strongly marked alternations of dry and wet weather, as to give a decided character, and apt name to opposite seasons. In summer certainly we have more cloudy days, and in winter expect a longer continuance of fine weather; but where the circuit of the year exhibits such moderate extremes, that no certainty of prediction as to next changes for even one week forward can be safely asserted, it is doing the colony an injustice to conjure up ideas of tropical violence by distinguishing the seasons into the dry and the rainy. Where, as on the coast for example, difference of temperature marks alternate periods of the year, it would be better to use the terms cold and hot; but when the circumstances of all elevations come to be considered, we could not, in my opinion, have a more proper or convenient division of the year, than the old fashioned one of spring, summer, autumn, and winter. In the upland districts of the colony, at all events, seed-time and harvest mark as distinctly two appropriate seasons, as does the passage of the sun through the two opposite solsticial signs of the zodiac. And, though new comers will not fail to be struck with the extraordinary extremes of daily temperature frequently observed, and the more definite and persistent character of weather, according to season, so different from the vicissitudes of an English climate, still there is something pleasing and encouraging to find that they do not experience any very violent change, either in habit or feeling, from the altered circumstances of present situation. The greatest incongruity probably to be overcome will be the necessity of accommodating themselves to the rule of

Natal contraries, that brings Christmas round in the middle of summer, and associates July with the cold and snows of winter.

SECTION 2ND.—*Geology of Natal, in connection with the general economy of human life in that Colony.*

Natal, in its physical geography, is no very great country, despite the continual assertions to the contrary of some little wits who, no doubt, would have railed, in his time, at the stature of St. Paul, and have constituted it an argument against the soundness of his doctrines. A few thousand square miles, approximately judged to be sixteen, situated between the 28th and 30th deg. of south latitude, and the 28th and 31st deg. of east longitude, are contained within the narrow confines of a new colony, destined by every fair inference, to be deduced from the circumstances of its situation, and general natural character, to effect a great social revolution in the condition of the hitherto almost inaccessible heathen nations of the interior of the continent. From its position on the flank, and I may add at the termination to the northward of that great feature of south eastern Africa, the Drakensberg range, or elevated crest of the basin of the Orange River, overlooking the Indian Ocean, Natal exhibits some remarkable differences from the general topography of the Kafir countries to the southward, as far as the borders of the old colony. Further, from its situation, it has been acted upon by peculiar influences, chiefly meteorological, that in its case have very considerably modified the results of a recent geological era; and to the operations of which, in common with the neighbouring, and of course related countries, its rock formations have been exposed.

If a stupendous natural fortification of a *redan* shape can be imagined as occupying all south eastern Africa, with one flank, steep, precipitous, almost as it were scarped, turned towards the south-east, and another facing the north-east, but falling away in a long irregular *glacis* of low hills, gradually diminishing in height, we realise to some extent a rude model of the surface geography of all the countries, which ought properly to be considered in general connection with Natal; for the salient angle, as military engineers would call the point upon which the flanks converge, immediately overlooks this colony, and as near as may be

on the same meridian, at some seventy miles distance, and west from the city of Maritzburg.

The water-sheds of rivers most naturally describe the character of mountain chains, and if properly laid down on maps constitute sufficient guides to form correct opinions of the most prominent features of a country. Thus the short direct course of the numberless streams of the eastern coast tell of a precipitous descent, and contrast with striking effect to the long, inland, tortuous Pongola and Meriqua rivers, draining the wide expanse of country to the north-west of Natal, and as both aspects, again, present counter slopes in different directions, they give the general south-western bearing of the basin of the Orange River, lying in the angle between the two diverging ridges which define these several and distinct water-sheds.

The geological constitution of that portion of the slope of these flanks of the Drakensberg, which is occupied by Natal, presents, it would seem, also two different characters and aspects. The late Dr. Stanger, who made a tour of inspection in 1856, reported "that the Drakensberg, instead of being considered one continuous chain of mountains, may be more correctly divided into two, of different geological structure, and having different directions; the one forming the north-western boundary I shall call the great Drakensburg; and the other, forming the western boundary, the small Drakensberg.

"The north-western portion of the Drakensberg is of the average altitude of 5000 feet above the sea, and about 1500 feet above the general level at its base.

"The outline is in general round and soft, presenting a some remarkable features, and occasionally high table lands, with precipitous sides. These mountains are composed of beds of sandstone cut through by veins of trap, and diminish in height as they advance to the north-east, until at some distance beyond the source of the Umzinyati they appear to terminate in low hills. These are passable at almost any part by horses and cattle; but there are only three passes in use by the Boers, one near Bezuidenhout's farm, and one at De Beers, and another a little more to the south-west of Bezuidenhout's. The two former are in constant use, the latter rarely.

"Timber abounds in the kloofs on the south-eastern side of the mountain. On the north-west the country is much higher, being a plain of great elevation.

"The great Drakensberg, or that portion of it which forms the western boundary, has a direction of N.N.W. and S.S.E. The junction of this with the former or smaller Drakensberg is ten or twelve miles to the southwest of Bezuidenhout's pass. From this point the Uku-tela rises.

"These mountains are much higher than the others, and are quite impassable, presenting a rugged outline, and bold and precipitous escarpments. From a distant view, from the nature of the outline (not having been near them), I infer that that they are granitic.

"How far the range continues to the S.S.E. I am unable to say, nor can I obtain any information on the subject"*

This terse, and rather bald description of the Drakensberg range, where it bounds the colony of Natal, has the recommendation at all events of being graphic, as far as it goes, and perfectly reliable. Dr. Stanger, had he lived, would have taken a high position among the naturalists of his day, and we should, no doubt, by this time have obtained, through his means, a very correct knowledge of the general physical character of the country. It will be perceived, however, that the view he gives of the chief features of the geology of Natal varies somewhat from my idea of the salient angle of a fortification, with its two diverging flanks, inasmuch as, that portion having a north-eastern aspect, or, according to Dr. Stanger, a N.N.W. and S.S.E. direction, is, where it surrounds the Weenen and Klip River divisions of the colony, deeply indented by the denuding influence of the principal sources of the river Tugela, which here take their rise. In fact, a second or retiring angle has been formed, exactly where the main or tap-spring has advanced beyond its thousand and one fellows, which on every side eat into the wall of the elevated plateau above them. But this has been the result of time, and can only be considered as an accident, not an original feature of the formation; the idea of which, I think, will be better conveyed by the simple illustration I have employed, than by burdening it with any complication of detail, and such which, in fact, really belongs to a subsequent and dependant natural operation.

From the bold natural feature of the Drakensberg, just

* First Natal Blue Book, 1848, page 78.

described, to the river Tugela, an elevated ridge line extends, running almost due south-west and north-east, and in a general view parallel to the whole line of the coast of south eastern Africa. This separates the proper basin of the Tugela on the one side, from the two watersheds on the other, of the Umgeni and Umvoti rivers. A secondary crest, which leaves the ridge last mentioned about midway, divides almost immediately, and proceeds in two diverging lines towards *termini*, on the coast marked by the mouths of the two last-named rivers. Between the bifurcation thus formed, many smaller streams have independent courses to the sea; the chief of which are the Umhlanga, the Umhloti, the Tongaat, and the Umhlali. In this manner a succession of terraced steps of unequal magnitude are described by the rivers that traverse them, from the lowest and nearest the Bay at Durban, the Umhlanga, to that of the Umhlali, the sources of which eat into the exposed cliffs of the Umvoti level above. One step higher, certainly a giant stride, and we stand on the plateau of the Mooi River branch of the Great Tugela, and where we will pause a little whilst I describe a similar scale of ascending river levels, which to the south of the Bay, equally as on the north, seems to characterise the general water-system of the colony.

Beginning with the very recent Umslatuzan, emptying itself at the head of the Bay, we perceive it extends backward at the expense of its neighbour, and immediate predecessor in age, the Umbilo. The latter preys on the more elevated bed of the Umllass, and this on that of the Umcomas, which in its turn yearly diverts, by progressive denudation, some rain-drops that would otherwise have been directed into the Umzinculu above. Having thus reached, on this side, the level of the latter, we find ourselves at the base, and in front of the very point of the salient angle in the Drakensberg before referred to, and may either climb its extremest height, by taking, on the one hand, the rise to the right, or north, where it is continually crumbling before the advancing sap of the earliest tributaries of the Tugela; or, choosing the other, ascend by the left, and scale the rampart, led by one of the sources of the Umzimeulu; the two great river boundaries of the colony, north and south, and the mouths of which on the sea coast are separated by nearly two degrees of latitude, here, as it were, extending towards each other a mighty arm,

to unite in a special embrace around their mutual charge, Natal.

Another remarkable feature of this very extraordinary river arrangement, is the fact that, between the two ascending *scala*, one on either side, an independent stream, the Umgeni, lies in the trough of the triangular formed depression, which, on a highly inclined plane, extends from a base along the sea coast, to its apex in the Drakensberg, the aforesaid salient angle of my topographical view of the country. This river, and its connection with the Bay at Durban, by some considered to be its proper estuary, particularly requires attention, as the contemplated phenomena exhibited, and just described in relation to the water-systems of Natal, can only be explained by a careful examination of all the circumstances which have contributed to the production of such a singular and striking configuration of surface.

It will be necessary, however, to digress somewhat, to describe in the first place the particular process by which nature seems, continually, to be endeavoring to counteract the otherwise rapid erosion of the continent along its south-eastern coast-line, by the constant marine current flowing to the southward I have before had occasion to make particular mention of, and to the powerful influence of which, the pyramidal formed extremity of Africa is universally acknowledged to be due. It requires also to be remarked here, that the direction of the ridge line of Drakensberg appears to have been moulded into its parallelism with the coast by aerial currents, acting always in one general direction, but alternately backwards and forwards, according to season, from the opposite quarters of the south-west and north-east. And further, these winds differ as diametrically in condition, the former being cold and wet, the latter hot and dry, and act and react by alternate expansion and contraction, with crumbling effect upon the general rock of the colony, a close-grained crystalline formation of a blueish grey colour, from the iron in a state of protoxide with which it abounds, and which, when thus freely exposed to the chemical action of the atmosphere, becomes rapidly converted into a peroxide, the broken and decomposed *detritus* forming a red soil of a much greater specific gravity, and occupying in its new condition more than double its original space as a compact and intact mass.

Acting, nearly at right angles with the direction of effect produced by these powerful agents of denudation, the ordinary action of fallen and running water has, however, considerably modified the result upon the face of the country. The primary operation seems to be to form, upon the exposed incline the Drakensberg presents towards the east, a succession of level plains or terraces, at unequal heights, over which the conflicting winds scour, acting with decidedly levelling integrity, by a constant equal effect upon a general, and throughout persistent, rock formation; and by filling up inequalities with the detached particles of mechanical erosion, or by the altered material of chemical conversion. Over the edge of every successive terrace, has also formed a *talus*, or connecting slope of drifted or fallen material, and it is curious to observe the specific differences of appearance the two situations present; the soil formed *in situ*, on the flat plains of the terrace tops, being dark red or brown, from having been less exposed to the oxydization of the air, than the bright red secondary product, constituting the connecting slopes between two different levels. In the second place, running water, as an agent of denudation, is affected by gravity, and seeks the shortest and most direct route to the lowest level, the sea coast, and, theoretically, would therefore intersect, at right angles, the parallel lines of the terraced heights just described. But, in nature, innumerable obstacles exist to interfere with and prevent the practical development of this exact conclusion of a normal operation acting without impediment. We only perceive the abstract principle asserted in the general character of the river courses of south and south-eastern Africa, all of which, from the confines of Natal, round to the west of Algoa Bay, as far as the longitude of Cape Aguilas, precipitate themselves in the easiest way to the sea, down the terraced steps into which the face of the high lands has been cut by the constant direction of the currents of air directed by the line of coast in these situations. In the district of Natal itself, however, a remarkable deviation is observed, for whilst the usual tendencies of surface configuration can be distinctly recognized, still it is evident that its rivers, instead of taking the shortest possible route to the coast, diverge from a common point in opposite directions, leaving a large triangular shaped depression or trough between, the base line of which marks the extent

of deviation from a simply direct course of the Umzimkulü and Tugela rivers.

To explain this remarkable topographical feature, is the problem of all others the most interesting to scientific inquirers in Natal, as it is, also, in our present state of knowledge, the most difficult. Its solution will involve, I believe, many principles of meteorological and geological importance, as yet unknown, and to discover which will require the patient examination of this district by a succession of observers, each following, and whilst taking the advantage of their experience, correcting the errors of his predecessors. But I am not to be deterred by the consciousness of the discrepancies future writers may detect in my views on the subject, now, and the real facts of the case when light from numerous sources shall have been directed to its successful illumination. My excuse will be one constituent in the candour of truth, which always recognises the services and difficulties of first explorers, even if it does occasionally laugh at the wrong, sometimes absurd, conclusions the temerity of half-informed, but speculative, minds often leads them into.

The natural history of the Bay at Durban is the key with which I purpose to decipher Nature's handwriting on the surface and the rocks of the country; and as usual with narrators, in commencing I shall go back to an immeasurably remote period of time, when the relative positions of the ridge of the Drakensberg, and the coast line, were very different from what they are now found to be. However, no one who admits the powerful influence of continual denudation will attempt to deny, that rivers, as they eat their course backward, and lengthen themselves yearly by an appreciable quantity, must formerly have been much more diminutive than under present circumstances, and therefore, as a necessary consequence, that the highlands they have disintegrated and carried away, must have occupied a very considerable extent of the distance between the existing ridge line and the sea. Again—as in still, sheltered seas the results of extensive fluvatile denudation are well known gradually to grow into habitable and improvable deltas at the mouths of many large rivers, so also we may naturally expect to find that wherever favorable circumstances exist, even on a seaboard, for deposit and accumulation, the same advance of the land at the expense of the ocean will take place. And this brings us

to another consideration, novel and interesting, and which will not fail to arrest the attention of every scientific enquirer, who, perhaps for the first time, will learn in what manner an extensive belt of elevated land has been naturally warped, and drifted up from the bed of the Indian Ocean, and that, too, in the teeth of the strong marine current presumed to be constantly eroding and degrading the south east coast of Africa.

As assisting the distant reader to realise my ideas upon the subject, a general view of the peculiar uniform characters of the outlets of the numerous rivers of the colony will not be out of place here, and as it will apply equally to the neighborhood of the Bay at Durban, as seen from seaward, it will serve to introduce my account of that singular geological feature of the coast, and its relation to the general geological history of Natal.

A bold bluff, sometimes from two to three hundred feet high, as at the Bay, projects into the sea, terminating a bank of like elevation, and consisting of drift sand and broken shells cast up by the waves. This almost invariably forms to the south and windward side of the outlet of a shallow stream which creeps, as sailors would say, under its lee, whilst on the opposite side, to the northward and east, extends a long low bank or spit of sand, gradually increasing in height and breadth as it advances into the general line of coast, where again another bluff repeated, indicates the presence of another river entering the ocean under nearly exactly similar circumstances, at the average distance of not more than ten miles from each other. Modifications of this singular natural order (for the instances are numerous enough, and sufficiently regular to form a group in a system of rivers) do occur, and not only prove, but serve usefully to explain the rule by unmistakably demonstrating the causes and *modus operandi* which have produced this characteristic uniformity in the estuaries of south eastern Africa. One of these remarkable exceptions, the Bay at Durban, and another in the Zulu country, around St. Lucia's Bay, afford the best illustrations I can possibly give.

Until the month of April, 1856, from the mouth of the Unvaloos, in latitude 19.30, to the southern border of Delagoa Bay, a distance of 140 miles, no river entered the sea. However, from this river, for upwards of one hundred miles northward, with a variable breadth of from one

to fifteen, or even to thirty miles, extended a shallow lake, varying in distance from the sea three or five, and in some places as far as eight miles. It communicated, and does always, except in very dry seasons, with the sea, by the river Umvaloos, and has received the name of St. Lucia's Bay from information partial and obscure, and from imperfect observation, having led to the idea that it was an inlet of the neighbouring ocean. Those hunters and travellers who have visited the locality, concur in representing the space between St. Lucia's Bay, or lake, and the sea, to consist of a loose sandy formation, and recognise it as being a product of the same operation of the winds and waves conjoined, which has raised along the entire coast a line of dunes of unequal height, consisting of drift and blown sand. In this situation a more than ordinary continuity of surface has been obtained, no rivers of sufficient size or water power existing, to force a passage through the continually increasing accumulation of oceanic *debris*, and, in this manner, an extensive district has become gradually formed, effectually damned out, and protected from the occasional fury of the waves, and which in the dry season exhibits a succession of swamps overgrown with reeds, rushes, and mangrove trees, and in the rainy months is converted into a vast expanse of shallow water, covering many hundred square miles of surface. Into the lake so formed numberless little streams empty themselves in the season of their gladness, all of which temporarily drain the *talus* of an elevated terrace plateau called the Bomba range, on which flows, in an almost due northwardly course to the Umsoota and Delagoa Bay, the large river well known to traders, under the name of the Pongola. Let it be properly understood I am now speaking of a time previous to the extraordinary rains of April, 1856, when, as I shall have to relate hereafter, a great and unexpected change, though it has proved not to be permanent, took place in the water sheds of this particular locality.

About sixty miles further to the south than the so-called St. Lucia's Bay, a similar surface condition is exhibited, though on a smaller scale; the entrance of the Umslatoose into the sea being marked by an extensive but narrow lake which in the wet seasons sometimes extends thirty miles parallel with, and at a short distance from the coast.

The Bay of Natal offers other circumstances of difference from the ordinary character of the estuaries of south-

eastern Africa, all which may be referred to the same natural operations, acting under specific influences that have thus modified the usual result. Instead of a long narrow sheet of fresh water, we here find a nearly circular inlet of the sea, about two miles in diameter, protected on the south, by a long and comparatively high bluff ridge from the heavy south-east seas and winds. On the east, it is further separated from the Indian Ocean by a low barrier of loose sand, covered with bush, whilst to the north and west, abutting upon the Berea range, a sandy plain surrounds it, of no very great elevation, the whole forming a kind of irregular triangle, the base of which is the Bluff, and the apex at the true mouth of the river Umgeni, five miles distant; where the back beach, on the one hand, and the Berea, on the other, are only separated by an occasional channel of communication between the said river and the Bay, in seasons of extraordinarily excessive rains. At the head of the Bay, as it is called, or at that angle where the Berea approaches the Bluff base of the triangle, is another much wider gap, where now two or three little streams empty themselves into the Bay; and a long flat leading direct to the mouth of the Umlaas, and skirting the entire length of the Bluff, inland, suggests the probability that the latter, for some time previous to the later appearance of the plain of Durban, and the present Bay, was an island close to the shore. At that period, the waves must have washed the foot of the Berea ridge, and besides a little stream, the present Umbilo, degrading its seaward slope, no other river existed in this situation till we reached the Umlass.

Another short digression is a necessary step in my process of elucidation of the early condition of the surface of Natal, and the systematic manner in which its rivers, one after the other, seem to have come into existence.

A necessary consequence of the continual degradation of the terrace cliffs or walls, by water collecting and issuing from their base, is the yearly diminution of the area of the plain above; and whatever river flows thereupon, of however great a magnitude, is exposed to the certainty of some day or another having its bed encroached upon by this wasting process; and ultimately, its waters diverted into a new channel, will take the course of some intruding, but younger stream, occupying a lower level, and offering a more direct communication with the sea. Thus the Mooi

River branch of the Tugela, at some future period, will be directed into the Umvoti or the Umgeni, as the sources of these rivers are effectually sapping the higher plateau above, and are annually conveying to the sea several thousand tons weight of its crumbled rocks and soil, and of course lessening, in a corresponding degree, its superficial extent.

We are not left in want, however, even in our own times, of some strikingly illustrating example; for nature, with whom violent operations are the exception, and almost imperceptible changes the rule, in thus altering the courses of rivers in Natal, and the adjoining countries, works gradually and slowly. Many oscillations between final results and returns to old conditions occur, and she requires to be patiently watched—most assiduously wooed—would we win from her the rich reward of truth. I have before alluded to the changes which took place in the surface conditions of the country north of St. Lucia's Bay, and to the non-permanence of the results which followed the excessive rains in April, 1856. From a native hunter in the employ of D. Koch, Esq., of Durban, I received the information that in traversing this part of the Zulu country, he was surprised at finding a large and deep river flowing towards the sea, where, from his own experience, he knew no river existed previously. On inquiring of the inhabitants, however, he found that the phenomenon was not unprecedented, for they told him, that it was the river Pongola resuming its old channel, instead of flowing northward, as for a generation or two it had done, into the river Masoota, and so to Delagoa Bay. This man's information was corroborated also by a reference to old maps of Africa, of Portuguese origin evidently, for in the situation so described a river is laid down as entering the sea to the eastward, and named the Rio d'Oro, or river of gold; but where, the evidence of numerous traders and travellers goes to prove, that at least for the last thirty or forty years no such river was to be found.

It is, further, pretty well ascertained that the district drained by the Pongola has all the usual characteristics of river terraces as observed in Natal; overlooking the sandy plain extending towards the Indian Ocean (its southern part occupied by the marshy flats and shallows of St. Lucia's Bay); and in its turn, being overlooked by another elevated plain, on which flows some early branch of the

Masoota river, taking its origin on the north-western or inland slope of the great Drakensberg range. It may therefore be fairly inferred that some one of the numerous little streams that rise on the short seaward slope of the Bomba plateau, has gradually encroached upon the bed of the Pongola, so as to admit, upon occasions of excessive floods, as in April, 1856, of a direct communication taking place between the swollen current of the old river, and the newer channel in progress to the eastward; especially if, as would naturally be the case in the broad shallow estuaries of African rivers, the *debris* of all kinds brought down with the flood, should choke up the ordinary mouth, and compel the river to find some fresh outlet, just as, under the same circumstances, and at the same time, the Umgeni, impeded at its entrance into the sea by an enormous accumulation of drift ruins and sand, beat up by heavy seas from the south-east, broke through and over its ordinary channel banks, and rushed, a deep and broad torrent, into the Bay at Durban.

There was a time also when the Umgeni appears to have been barred out from entering the sea by the range of the Berea, then extending in an unbroken line of drift sand, covered with bush, as far north as the Tongaat. It seems arbitrary to stay it there, without observing that the latter river is upon an elevation, gently inclined towards the coast, and the exposed cliffs of which, inland, are denuded by waters rising at the base, and running into the little streams that now drain the presumed area of the former lake of the Umgeni, and testifying, therefore, to a considerable lower level than the watershed of the Tongaat. Still it must remain a question whether this plain may not also have originally formed part of the bottom of the lake, for it is just in this situation that the greatest and most incontestible evidence of elevation by recent volcanic agency is to be seen, in the strata of coal and sandstone traversed by numerous narrow dikes of trap, all lifted up and exposed on the coast, about midway between the Tongaat and the Umhlali. And to this disturbance, perhaps, may be really due that alteration in the condition of the coast line, which it is evident has taken place, from the many circumstances existing to prove how different a state of things have once prevailed. It is my present purpose, however, to detail a more direct cause of the comparatively recent formation of the plain, &c., of Durban,—the Bay, of course, included.

Plutonic agency may have accelerated or even confirmed results by alteration of levels, and producing modifications of other existing conditions, but to me this appears more in the character of an accident, than part of the natural system always operating in extending seaward the borders of Natal, by a process, on a grand scale, not unlike the "warping" of land from the German ocean in use on some parts of the coast of Lincolnshire in the old country.

I have previously said that the ridge line of the Drakensberg must, at some time, have been very considerably nearer to the sea than it is found at present, and even ventured to surmise as much as fifty miles. When I add, it is also my opinion that the line of coast was originally quite as far inland, and that it has gradually extended at the expense of the adjoining ocean, my readers may feel some surprise at the boldness of the idea, especially as denudation, on the one hand, and re-deposit, on the other, does not, nor can, alone account for all the phenomena exhibited in the so acquired districts, although on these it may be perhaps expected I ought to depend to prove the position I have assumed. Another difficulty in my way will, no doubt, immediately suggest itself, in the known circumstance of the powerful marine current which is supposed to be constantly wearing down and removing the exposed shore, and which, indeed, according to my own admission, has been the principal cause in producing the pyramidal formed extremity of the continent of Africa.

The succession of terraces rising above each other, and the constant progress backwards made by the several rivers, result in the higher, or more elevated, streams ultimately succumbing to, and taking the course of the lower; and when, as is always the case, the latter is much the smaller of the two, the additional volume of water consequent upon the junction, naturally leads to great alterations, both in its general character, and in the previous condition of its termination on the coast. The latter is especially affected, for the combined *weight* and *speed* of the increased flood is sufficient to divert, or even to suspend, within the limits of its influence, the littoral currents of the ocean, which, it must be remarked, although varying in force and direction according to the character of the coast, whether sheltered in bays, or exposed around headlands, have a general set to the northwards, in opposition to, as

being reactionary upon, the great marine current running in the opposite direction.

A striking illustration of the natural operation just detailed, is afforded in the altered conditions of the original coast termination of the Umgenei in a long narrow lake, separated from the adjoining ocean by a high dune of drifted sand and broken shells; one of which in progress may be instanced in the present Bluff. The drainage area of this river during its presumed lacustrine era, may perhaps have been as far westward as the locality now called York, twenty miles north of Maritzburg. By constant denuding action upon the general slope of the Drakensberg, its tributaries in the course of time had greatly increased in number, until, having effected a sufficient breach in a higher terrace, bearing upon its surface an important branch of the Tugela, on the occasion of a considerable rainfall, the gravity of the inundation was sufficient to break down all remaining obstructions, and burst its way into the encroaching Umgenei, and for the future take a more direct course towards the coast.

The lake in which the latter river terminated would of course exhibit a corresponding change in its condition. Its bed already shallowed by the constant deposit of mud brought down with the waters from the interior, would be but a few feet below the crest or ridge of the dune shutting the lake out from the sea. The sudden influx of an extraordinary volume of water would naturally press upon some weak point in this barrier; and where previously, perhaps, a little escape or overflowing might occasionally have taken place under ordinary circumstances. Here, then, the rushing out of the doubly augmented flood of the conjoint rivers would quickly excavate a deep ent through the walls of this natural dam, and enter with surging violence the sea, tinging its blue waters, afar off, with a novel hue, and deflecting the littoral current out to some distance from the shore. From the new river mouth thus formed, and under the lee of its strongly flowing influence, would extend a space of tranquil sea, in extent proportionate with the diverting power applied and defined by a line, where the marine current gradually reassumed its original direction along the coast. In the case of the Umgenei, this is now represented by the Point and Back-beach, in front of Durban and the Bay, for under the favorable circumstances offered, the south-east wind and wash of the

Indian Ocean would soon deposit a large sand bank within the prescribed limits, and, as a base to the whole, the Bluff would, in the course of time, appear above the waters, produced by exactly the same natural causes that previously, along a similar line of greatest oceanic drift, had resulted in the lengthened dune of the Berea range. The site of the former lake would now be transformed into dry land of some considerable elevation above the level of the stream, flowing in a deeply excavated channel, cut through the thick stratum of clay and mud deposited during its previous condition. Numerous little rivulets would also intersect and drain this extensive plain, until progressive denudation had moulded the scene into numerous rounded gentle hills, with many verdant vallies between, such as may be well observed travelling along the Maritzburg road from Durban, over and past the Berea, and as far on as the farms of New Germany.

This unfolding of one page of natural history, in connection with Natal, has not been alone suggested by the circumstances connected with the origin and formation of the present estuary of the Umgeni. In the great inundation of 1856, a partial illustration was afforded of the transimmary local effect produced by an unusual impediment stretching across the proper mouth of this river, and preventing the free escape of its waters into the sea. On this occasion two obstructions were observed to form in different situations, and of course with varied effect. The first occurred in the narrow gorge in the Berea, where the extraordinary cut through first drained the former lake. Here accumulated a vast quantity of *debris*, consisting of torn up trees, roots, and wreck of all descriptions; of the magnitude of the sources of which may be judged from the fact that an island of reeds, formed in the middle of the stream, in extent about fifty acres, was bodily lifted up, and carried *en masse* into the gorge, as my informant described it, broadside on. The effect was to raise the level of the inundation several feet on the Umgeni flat, until the surging efforts of the pent up flood ultimately brought the floating island end on, when it was hurried, an avalanche of sand, and mud, and tangled vegetable ruin, partly into the sea, and partly directed through a new breach in the bank of the river, into the Bay, at one time threatening to sweep away even the town of Durban before its irresistible current.

The cause of this latter phenomenon was the second obstruction at the mouth of the Umgeni referred to above. The extraordinary fall of rain over the whole district, in the month of April, 1856, was attended by a long continued prevalence of south-east gales, and a heavy set of the ocean from the same direction. From its depths was dredged up, as it were, a vast quantity of sand, and heaped upon the shore, where, mixed with the broken rubbish brought down to meet it from the interior, new lines of banks, fifteen or sixteen feet high, were formed for miles and miles continuously. The mouths of all the rivers on the coast were affected by this accumulation of drift, which materially increased the extent of the inundations inland. In the case of the Umgeni, it sought an extraordinary passage to the sea, but one which, not only abundant topographical evidence exist to prove that it was an occasional channel, but even within the experience of white colonists, say ten years previously, a like occurrence had taken place, under nearly similar circumstances, and also, be it observed, in the same month of the year, showing some connection with season, as sometimes, during the autumnal equinox, violent south-east gales prevail for many days together. On both these occasions the river came down on the inner side of the Back-beach, past the camp, and into the Bay by Cato's creek. In 1856, it occupied the whole breadth of Stanger Street, which was converted into an unfordable stream, several feet deep, that hurried one man lifeless into the Bay, and another strong swimmer I myself saw carried down above one hundred feet before he made the opposite side; escaping from a small house surrounded by the waters, and the site of which was being washed away at the rate of many square yards a minute.

It must have been under circumstances of an exactly similar nature that, at the same time, the Pongola river in the Zulu country was diverted from its usual entrance into Delagoa Bay by the *embouchere* of the great Masoota, and turned into the old channel north of St. Lucia's Bay, and where it reached the sea, when the Portuguese maps previously referred to were constructed. On this occasion, the direction of the lower third of the river's course was changed from north to nearly due east, and the distance of coast line between the usual and the temporary mouth of the river, was upwards of three hundred miles. At present the country has resumed its ordinary appearance, and the Pon-

gola has again united with the Masoota, forming a kind of delta at the western extremity of Delagoa Bay. The occasional channel I have just been alluding to is now obliterated, for passing through a plain of loose sand, but little elevated above the sea, the alternate monsoon winds from the north-east and south-west, are in ordinary seasons sufficient to drift up all inequalities of surface; the operation, of course, being furthered, or, on the contrary, retarded, as the succeeding season to one of extreme violence is more or less dry. It requires, however, no great powers of prediction to foretel that, at some future day, the Pongola, after numerous oscillations in its position, such as even present history records, will permanently enter the sea where its extraordinary floods now sometimes seek a direct channel. This new entrance, again, the south-east gales and roll of the Indian Ocean will frequently dam up, and a state of things result that will exactly parallel my idea of the past history of the Umgeni, and its relations with a vast inland lake behind the Berea range, the exact prototype of which I believe to be the present St. Lucia's Bay. When the Pongola turned to the southward, behind some obstructing dune, is forced into this latter, the increased volume of water, and constant current, will find and keep open a way into the sea, where windward circumstances are favorable to protect the entrance, and the consequence will be, that the present lake will become a dry habitable plain; in deep excavations of which will flow draining streams, until, as usual, denudation has moulded into softer features, the first dreary and uncouth aspect of the country.

But that the natives themselves have some idea of these progressive geological and geographical changes, is well illustrated in the names they have given to several places where they could not help observing a repetition of nearly similar natural phenomena. Local nomenclature also constitutes a kind of history, the confirmation of which we find in the evidences of surface changes that geological enquiries afford. Thus we have a *Matta-coola*, or "great water" immediately to the north of the Tugela, the name, to-day, of a small stream, but formerly given to a large lake, extending in this direction, and the level of which, before drained by the intrusion of the Tugela, I measure by a high hill top in the neighborhood, called the "Coma," or "island," as I interpret it, a name given to it when, as

no doubt it once was, surrounded by water. In the Bay of Natal, the same word is used by the natives to designate "the island," although an absurd tale of Dingaan's warriors having mistaken the mangrove trees for *incomo* (*i. e.*, cows), on the occasion of some Zulu commando, and being undeceived, retiring in disgust, is popularly given in derision, as the origin of a name which, in my opinion, has a much more natural and intelligible solution.

Into the head of the Bay also empties itself a small stream called by the natives the "Umslatuzan" (signifying the *Little Umslatuse*), a name evidently suggested by the coincidence of its termination in an expanse of water, like its greater prototype in the Zulu country, and a general idea of some other resemblance of local features. And this is further confirmed by the next river to the Umslatuzan being called the "Umlass," as the corresponding contiguous stream to the Umslatuse is the "Umlalas," both possessing the distinguishing characteristic of being affected by the flowing tide to a considerably greater distance inland than is to be observed in most other rivers on the coast, and which may have occasioned the nearly similar names being given to the two situations.

The greatest difficulty in connection with this question remains to be noticed. This is the repeated occurrence, at different elevations, of the same recent rock formations, and similar to what we now see forming on the coast. The inference is, that they have resulted from a like natural history, and that situations and places now many miles inland, and elevated several hundred feet above the present level of the sea, were formerly exposed to the oceanic influences of tide and drift to which these sandstones evidently owe their origin. The best evidence of this is contained in the bands of coarse quartzose sandstone, which frequently forms the eastern boundary of some former lacustrine site, as instanced at York on the Umgeni, which I believed formed part, at some distant time, of the then termination of that river in an inland lake, barred out, as usual, from the sea by an extensive dune of sand. All along the coast district this sandstone formation may be observed for some miles inland, extending in long ridges, of no very great height, and characterised by a coarse gritty grain, with numerous veins of almost pure quartz striking through them in almost all directions. Of the origin and nature of these veins we are not left in

much obscurity, as they may be observed in all stages of formation, from the first filmy deposit of minute crystals along the two sides of a narrow fissure, the interval between being partially filled with a fine reddish colored clay, to the closest approximation of the two crystallized surfaces, and which, in some hard specimens, even require a smart blow to separate them along a medium line, whilst in others the junction is completed in an inseparable mass of compact quartz.* It seems, therefore, that the veins are a subsequent development in the sandstone, consisting of quartzose particles, segregated, as it is termed, by an eclectic process, from out the general substance of the rock, and re-deposited in cracks or fissures that have accidentally been formed by contraction or disturbance of some kind or other; such as an altered condition of general temperature, or the mechanical shock of an earthquake, might be supposed to cause. Fossil shells are a more familiar illustration of this segregating process, as they are generally mere casts, the particles of the natural body having been as curiously and as mysteriously conveyed away and substituted by others of the general character of the enveloping rocks.

From the remarkable parallelism of the course of the Mooi River branch of the Tugela with the present coast line, I am inclined to believe that it also flows on the lee side of a former extended dune of sand, indicative of an ancient sea board, when the Klip River district here exhibited a long narrow inland lake. This opinion is strengthened by the direct course of the principal tributary of the Tugela, and its rapid erosion of the Drakensberg in this situation, as to it must be chiefly ascribed the indent, or re-entering angle, in my assumed figure of a gigantic fortification, of which I have before spoken. This may be readily recognised as the draining stream of the altered level of the country when the sea retired to its present position, probably at the era when the whole of

* In a communication made to the *American Journal of Science*, vol. vi. (Library Natal Society), by the Rev. Mr. Hitchcock, on the geology of Connecticut, I find that that gentleman observed a somewhat similar structural character in granite veins. At page 15 he remarks—"I have, however, frequently noticed a seam traversing the middle of the vein—so that if the rock they traverse be broken up, one half will cleave to one side, and one half to the other."

this coast was the theatre of extensive volcanic convulsions, such as occasioned the protrusion of that singular but circumscripted development of granite in the Zulu country, called the Umgohe mountains, and which would, also, account for the extraordinary evidences of the same fearful agency having been in active operation at a comparatively recent period, at the confluence of the several branches of the Tugela, where it escapes from the Klip River district, and also on many points of the coast of Natal.

A careful examination of the bed of this main or tap stream—as I term it—of the Tugela, where it bisects the Klip River district, would be of the greatest importance to a true knowledge of the geology of Natal. As this subject, however, is only incidentally a part of my present task, I must leave it, and all considerations connected with it, to further opportunity. This much I must observe, that before denudation had made such inroads into the Drakensberg, and at the period of the changes of level consequent upon volcanic agency, the Umgeni must have presented very diminutive proportions; its sources confined to draining the slopes and mural face of the higher level now described by the country around Lidgetton, and entering near York what I can conceive to have been a placid bay, communicating with, and having the same relations to the then ocean, as has the present bay of Durban. At all events there can be no dispute that the whole valley of the Umgeni appears to be a prolongation westward of this chief feature on the coast. Its bed represents the lowest level of a vast natural excavation in the crust of the earth, of a triangular form, lying between the heights of the Mooi River, on the one hand, and of the Umcomas, on the other, the apex being at Spitskop, and its base on the sea shore. And the regularity in the conformation preserved throughout, makes it as remarkable to the curious observer as the somewhat analogous but contrasting character of a delta, both resulting from operations in progress, calculated, in the course of time, to effect very material changes, either in the surface or coast configuration of a country.

The most probable explanation of the *modus operandi* or nature's mode of proceeding, and the agency she employs in scooping out this hollow, drained by the Umgeni, is to be found, I think, in the circumstance that between the degrees of latitude which bound Natal north and south,

the line of equal power, between two contending volumes of air in motion, is for ever oscillating. It is just in this situation that, under favorable influences, depending of course upon season, the heated current of air flowing southerly from the heights of the atmosphere over the equator, first descends in a strong westerly wind upon the surface of the earth, meeting there in a very different condition, both as regards temperature and electrical nature, with the almost direct easterly breezes of the trade winds, at their greatest distance from the line, and affected by the moisture and chilling influence of the great southern ocean, and antarctic ice-fields, which sometimes extend in this hemisphere to extraordinary low latitudes. Wherever conflicting winds of the magnitude and character of such general currents of air meet in direct antagonism, similar evidences of extensive terrestrial denudation, mark the violence and force of the everlasting struggle, for though a calm may prevail along a narrow line of equal power, on each side of this will extend districts of disturbed and wind-worn surfaces. Between the Bay of Biscay, proverbial for its storms from the north-east, and the opposite Bay of Lyons in the Mediterranean sea, receiving that somewhat ominous name from the occasional violence of its gales,* extends a flat expanse of sandy country, called "the Landes," generally admitted to have been thus moulded by the constant attrition of vast moving bodies of air, and which will ultimately, in the common course of nature, if the world as it is lasts long enough, subvert the political importance of the Pyrenees, separating Spain from France by an atmospheric machinery which is effectually sawing the two countries apart. But an illustration

* The Phœnicians were, I think, the originators of this name. Their capital city, Carthage, stood on the shores of an inlet of the Mediterranean Sea, called, from its usual placid character, "the Bay of Maidens;" a popular name to this day, *Bahr ul barrateen*, to describe similar quiet havens among the Arabs on the coasts of the Red Sea. The antithesis in name to the Bay of Lyons, is the more striking, from their relative geographical position being situated nearly on a line north and south of the same part of the Mediterranean. The Bay of Carthage, between the little promontory of Dakhull, the counterpart of our Bluff, and the mouth of the river Mejerdat—the site of the city on the north of a land-locked bay (now much altered of course by changes in coast line, during an interval of not less than 2000 years, but the former state of which, I believe, is closely reflected by the situation of the present city of Tunis)—the adjoining district on the flank of the great

more to our purpose of the excavating power of air in rapid motion, is well observed in the state of the isthmus connecting the peninsula of the Cape of Good Hope with the mainland. Here we find on the surface of the ground ridges of the primeval granite, and the still lower blue schistose rock, continuous with the same formation, upon which, on both sides, rest the quartzose sandstone, in deposits, as instanced in Table Mountain, of several hundred feet thick. Between Table Bay and False, better known as Simon's Bay, and in a due N. W. and S. E. line, the two prevailing season winds from these opposite quarters have evidently not only deeply indented the coast, but removed the masses of sandstone which originally, no doubt, stretched in an unbroken line across the isthmus. Algoa Bay is a still more analogous case, as it has clearly been produced by the constant denuding action of the south-east winds upon the exposed slope of the terraced heights, where commences the great Drakensberg to the southward. In fact, besides producing this grand feature of the coast, the operation has extended so far inland, as to have scooped out a large saddle back, as sailors term it, or notch in the highest part of the ridge, and has thus formed a marked separation between the eastern and western portions of the one characteristic tabular range, which with its seaward slopes occupies the whole southern termination of the continent of Africa. In this excavation flows the great Fish River, and although its mouth is many miles more to the eastward, I cannot help thinking that, together with Algoa Bay, it belongs to the same natural order of river estuaries, I have attempted to describe, in connection with the Umgeni and the Bay at Dur-

tabular range of the Atlas, which occupies all the north western angle of the continent, correspond so remarkably with many of the more prominent circumstances, geological and geographical, I have endeavoured to describe in connection with Natal, that I could not help drawing the attention of my reader to them, as a pleasant subject for reflective thought, especially when we consider that to the arrival of Phoenician traders and colonists, the dawn of civilization in Britain is to be ascribed. And now, after an interval of some thousands of years, that has witnessed many social, and one grand moral revolution in the history of man, we find a people of kindred character and pursuits, in the exactly opposite quarter of the continent, seeking to re-introduce that happy and enlightened condition which the most ancient recorded history, and the monumental remains of Egypt, sufficiently testify to have once existed in Africa.

ban, and of which so many other allied instances are to be seen on the same coast. Let it also be noted, that here is found, as in Natal, a road, gradually ascending on a convenient incline which has been thus cut, by a natural process, across the otherwise impassable mural faces of the successive terraces that rise to the ridge of the Drakensberg.

Having thus endeavored, by illustration, rather than exact definition, to convey my idea of the real character and origin of the prolonged excavation in which flows the Umgeni; having also shown how this was extended westward, at the expense of the high land behind, by one natural process, and its borders enlarged eastward, at the expense of the sea, by another, the reader cannot have a happily constituted mind, who is unable to realise the condition of this river in distant time, when its dimensions and pretensions were as diminutive and obscure, as are those of many of its younger fluvatile brethren observed on the coast at the present day, and the destiny of some one of which is almost certain to re-enact the circumstances of the past as regards the Umgeni's growth, even to the extent of converting this latter into a tributary stream, and depriving it of its chief glory, as the connecting link between sea and inland mountain, and becoming its successor, as the representative of a still lower drainage level, in a future geological era.

And this brings us again to the consideration of the difficulty connected with the evidences of a very considerable difference of sea level having once prevailed on the coast of Natal, from what is observed at the present day. But this is more relative in regard to former conditions of surface, than actually the case, although I cannot divest myself of a conviction that there has been, and is constantly going on, a general and gradual retirement of the ocean, as if its waters were being accumulated around the south pole, in obedience to some natural law, which has also effected, in such striking contrast, the great preponderance of land in the northern hemisphere. As respects the apparent withdrawal of the sea I allude to, this may be readily understood by reference to the necessary consequence of high cliffs, the base of which, in the first place, is washed by the waves, being thrown down, when the ruins, if unremoved, would form a long slope, advancing some distance upon the former sea bottom. I have not my authority to quote from, but I remember reading of some experiments to

prove the blasting force of gunpowder, made upon the face of precipitous cliffs 400 feet high, overlooking one of the harbours on the English coast, where a mass thus tumbled down was sufficient to project a new beach nearly one mile in front of its original line. If Table Mountain, near Cape Town, 3600 feet high, and only about five miles from the sea, is made to reflect a former condition of the coast of Natal, when the Drakensberg ridge line overhung its base, at an elevation and distance from the sea corresponding with that of Table Mountain, such circumstances would admit of the formation by deposit of a district intruding upon the bed of the adjoining ocean for upwards of one hundred miles, whilst during the period of change the ridge line of the Drakensberg would, by denudation, be as gradually removed to an equal distance in the opposite direction. Nor would this transformation of surface appearance involve any alteration in the present level of the sea, but would consist merely of a difference in the disposal of material from the form of high overhanging cliffs, to that of a gentle and gradual incline, exactly as is observed in Natal, where undeniably such a wonderful work of nature and of time has been most effectually carried out.

As regards the greater question of the retirement of the ocean from the shores of South Africa, and of which, in my opinion, very decided evidences may be observed in Natal, I shall not allow myself here to be drawn into its consideration. It is a subject upon which a lengthy dissertation might be written, and I recommend it, therefore, to the attention of any ardent or ambitious devotee of science, as offering ample opportunity for acquiring new information, or of attaining the distinction which will be sure to reward successful inquiry.

Hitherto I have confined my observations to surface peculiarities, and other prominent features of Natal, connected with its geology, but it is also necessary to make some observations upon the structure and constitution of its soil and rock formations, as the influence of these upon the human frame, and secondarily upon national character, though seen more in results than able to be detected in operation, cannot be disputed. The tractable, peaceable disposition of the natives, which through all ages has distinguished them, and is attested as much by those stupendous results of human patience and industry, the

pyramids and excavated temples of ancient Egypt, as by the modern testimony of the adventurous and indefatigable Livingstone, must be, I think, chiefly ascribed to geological agencies, operating with subtle effect upon the disposition of man, by exciting and encouraging the development of some physical medium in the frame, through which such qualities are exhibited; and which, in the case of the aborigines of Africa, constitute differences of moral nature from those of Europe or Asia, as evident, and as particular, as are to be observed in the somewhat analogous comparison naturalists might draw between the contrasting characters of the labourer and soldier ants. In the proper place I shall endeavour to show how this is effected, when commenting upon the remarkable change in constitutional condition, experienced by every new comer in the continent, but most prominently remarked in women, even from the time of Sarah, the wife of Abraham, whose son Isaac was born after a recent sojourn in Africa.

A naturalist coming to the examination of the rock formations of Natal, with a mind formed upon the subject generally, by reading and observation in the northern hemisphere alone, will be sadly at fault to arrange, under any known system, the appearances he meets with here. The singleness of origin, and remarkable uniformity of the results produced by operations now in progress, and which can be shown to have been persistent through all time (commencing at least with the elevation of the Drakensberg table land above the ocean), will surprise and perplex him. The very simplicity of nature is a considerable difficulty to be surmounted by the laborious student of geological details, familiar only with the complicated problems involved in the distorted, and often commingled ruins, of the various strata, entering into the constitution of the earth's crust, where he has obtained his knowledge. He will meet with no parallel circumstances described in his books, though some faint indications he may perhaps perceive, after he has visited Natal, in the condition of the northern flank of the great table land of central Asia, where it is drained by the numerous rivers flowing in one general direction towards the shores of the Arctic Ocean.

The idea which naturally suggests itself to a stranger travelling through the colony is, that one prevailing formation, the old red sandstone, is the prominent characteristic rock. But to the question why here it should be

called "old?" the visitor, I expect, would feel at a loss to give a satisfactory reply. Indeed it is with regard to age that the great difficulty consists of reconciling geological facts, as presented in Natal, with previous knowledge, based upon an idea of an orderly succession in time, of the various formations called primary, or the most ancient,—transition or secondary—and tertiary or most modern. To me it appears as if I were transferred to the era when the old red sandstone series was actually being formed, and when the tertiary period of then experience was witnessing the gradual deposit of the coal measures, and the, also assumed, still later development of the new red sandstone; for in Natal all these processes may now be seen in cotemporaneous progress. The study of that formation, to which the memory of the late Hugh Millar gives such mournful interest, may here be pursued in the very workshop of nature, divested of the complicated and confused relations, which succeeding revolutions in condition, and violent convulsions, operating on the earth's crust, have produced in the strata exposed to human observations in the continents of the northern hemisphere. However, I will not commit myself unnecessarily here upon this subject, further than to observe, that probably the next advance in geology will be, to return to the much more natural system of arranging rocks, in accordance with the circumstances of condition in which they were produced, than is the present artificial one, which is constantly being contradicted by anomalous deviations, and frequent conflicts of theory with observed facts. Neptunian and plutonic, with the addition of the terms segregative and atmospheric, which have hitherto been strangely overlooked as important agencies in effecting revolutions of condition in the crust of the earth, will afford an apt descriptive classification of formations of continental magnitude; less than which, indeed, scarcely deserve the distinction of being separated from the numberless subordinate groups of strata, formed and forming everywhere, in endless variety of constitution and extent.

In Natal, the atmosphere, acting with constant effect upon one universal elevation of greenstone, has reduced to a certain depth that easily decomposable rock, to a condition and character not distinguishable from some of the products of the old red sandstone era of European and American geologists. The operation is first to separate the,

normally, compact, closely grained, crystallized rock into blocks, sometimes exhibiting a decided tendency towards a regular columnar type, jointed along lines of equal height, so as to convey to the cursory observer a very delusive idea of regular stratification by deposit from water. In many localities exposure also betrays that spheroidal structure, greenstone, under some circumstances, is known to assume —large ball-like masses breaking up into concentric shells, before softening into a yellow clay. As disintegration proceeds, the stratiform tabular ranges of changed greenstone lose the original dark grey or bottle green colour, and become, according to situation, either of a dark or bright red; the former, on the constantly moist surface of the long continuous flats and table hills throughout the colony, and the latter, wherever the fallen *detritus* has formed a *talus* of a stiff loamy soil, abutting upon, and mixed with, fallen masses of stone from the cliffs above.

As greenstone thus constitutes the elevation, so granite may be considered the basis rock of the colony. This latter is generally supposed to be a mere dyke of plutonic origin, obtruded through a narrow fissure in the superincumbent strata, and which can be traced as such in a N. E. and S. W. direction throughout the colony. On the contrary, however, I believe it to be the nethermost rock of the whole series, upon which all the others rest, and, indeed, to be continuous, by some great subterranean reservoir, with the same kind of granite which appears beneath the so-called quartzose sandstone of Table Mountain, near Cape Town. This difference of opinion of course involves the age of the granitic formation. If I am right, then it must be considered of primeval origin, and anterior to the more recent sandstone and greenstone above. Should the truth, however, rest with those who think otherwise than the obtruded dyke must have appeared subsequently to the superincumbent rocks, and been poured out during some volcanic convulsion, through a rent or fissure in this part of the earth's surface. At the Cape, the granite is exposed in several places, quite sufficient, I think, to prove uncontestedly that the greenstone is the later rock, inasmuch as it is found frequently traversing the former in large veins. A remarkable instance of this exists a little below the top of the connecting ridge between Table Mountain and the Lion's Head, on the side towards Kamp's Bay. It is a trap dyke, easily distinguishable, by

its colours, from the coarse-grained, whiteish granite, which, as in Natal, contains a very large proportion of crystalline felspar, extremely subject to decomposition. "It appears as if it had been broken across in the middle, and the one half pushed sideways out of the line of the other, but still preserving the same direction. The rock of this dyke is of a greenish black colour, and has the appearance of being composed of spheroidal concretions, as is not unfrequently the case with rock of that class."*

If this greenstone formation is considered to be a result of the latest volcanic action that has disturbed on a large scale the surface configuration of the globe, we connect its appearance with the like unmistakeable evidence the whole continent of Africa affords, of some such great convulsion, which probably produced the three fissures, occupied by the Red Sea, the Gulf of Babelmandel, and that remarkable one, stretching westward from the same central point of greatest energy, but through the dry land, to the confines of Abyssinia. The isolated table lands on which flow the two great branches of the Nile, the Abi, and the Abiah, several hundred miles in extent, and elevated from 8,000 to 12,000 feet above the level of the sea, with innumerable other instances throughout central and northern Africa, of similar desert surrounded islands, point also to a period in remote antiquity, when the bed of a great ocean, acted upon by violent heat, ruptured and elevated, converted an archipelago into a continent, and perhaps witnessed, on the other hand, the disappearance of Plato's Atlantis, the destruction of the Titans, and the various giant offspring of Oceana, with the accounts of which mythological history abounds.

A submarine volcano might have poured out, within the latitudes of 30 deg. and 40 deg. south, a vast bed of greenstone, breaking through and overlying the older granitic crust; and such an operation, extending over a lengthened period, until a cumulative crisis approached, may be easily conceived to be possible, as they mark the chief circum-

* Banbury's *Journal of a residence at the Cape of Good Hope*, page 80. The observant traveller from Durban to Maritzburg, as he ascends the long cutting on the other side of Uys Doorn's spruit, nearly at the summit, will see on his right hand an instance of the same kind of protruded greenstone, but without that striking relief of colour afforded by breaking through a background of whiteish granite.

stances which surround the appearance of the lonely islets of St. Paul and Amsterdam, above the Southern Ocean, and which will serve to illustrate, to some extent, the idea I entertain of the origin and pre-Adamite history (if Usher's chronology is to be received as correct) of Natal and the adjoining countries.

But something, on the other hand, requires to be said, to satisfy not only the Neptunian prepossessions of some, perhaps, of my readers, but also the incontestible evidence of aqueous deposit, afforded by the sandstone capping which, over the Winburg district of the Free State, and Basuto-land generally, forms the summits of the numerous low flat-topped hills that stud the otherwise monotonous expanse of level plain. The stupendous quartzose cliffs, and huge pyramids of sand a thousand feet high, that Barrow describes as forming the very highest ridge of the great mountain range extending northward, on the southwestern coast, and of which, though at a much less elevation, the Cape Town Table Mountain may be considered a member, also indicate conditions of origin not to be explained by the phenomena attendant upon elevation by igneous energy of a portion of old ocean's bed. All objections, however, on this head, may be met by another argument, drawn from a presumed analogy between a former history of the western coast of Africa, and its present state, and the future objects to be subserved, in another geological era, in some comparatively shallow part of the great seas, where circumstances are favourable for the deposit of gravel and silt, so as to form a bank many thousand feet thick, and some hundreds of miles long. For example, if we submerge Europe and North America, not by a sudden convulsion, but by a slow, imperceptible, but certain operation of nature, and simultaneously raise above the waters of the Atlantic, in the form of a new continent, the great submarine terrace or table land which is known to extend between Ireland and Newfoundland, and of which advantage has been so conveniently taken to lay down the electric cable, which is to connect so intimately for the future the old and new worlds.* Let the

* In illustration of such a process of elevation, Mr. Babbage, in his *Observations on the causes of Geological Cycles*, has satisfactorily shown, that, "if a stratum of sandstone five miles in thickness should have its temperature raised about 100 deg., its surface would rise twenty-five feet."

now dry land be further subjected, through countless ages, to the usual meteorological influences of air and water, heat and cold, and at length be exposed to the ruder influences of volcanic forces, such as I referred to in the previous paragraph, and we have no very imperfect representation, if all the circumstances of surface are taken into consideration, of the general geological history of Africa; whilst it must be conceded, I think, that nowhere is there a better opportunity of examining into its constitution, even of its most inmost recesses, than in the deep weather cutting existing on its south-eastern flank, where occupied by Natal.

In a simple general view, therefore, the geological constitution of this colony may be described as a greenstone elevation, resting upon a basis of granite, and different as the two rocks are in appearance, an intimate relationship can be traced between them. Indeed Dr. Macculloch, in his *System of Geology*, calls the former a variety of the other, and remarks, aptly enough for my purpose, "in examining this duplicate compound (feldspar and hornblende) it is observed in some places to assume a fine grain, and at length to become undistinguishable from the greenstone of the trap family." Lyell, also, in his Elements of the same science, says, "It would be easy to multiply examples to prove that granitic and trap rocks pass into each other, and are merely different forms which the same elements have assumed, according to the different circumstances under which they have consolidated from a state of fusion." The chief distinctive feature appears to be the absence of crystalline quartz in the greenstone, and in which, also, very unlike granite, its separate ingredients are not apparent to the naked eye, being a fine-grained rock, breaking with a conchoidal or shell-like fracture, and varying in colour from a blueish grey to a dark bottle green. To observe all this, the traveller in Natal has only to break the first stone that is not granite, wherever the outcrop of this latter makes its appearance upon the surface, and compare the close structure and minute particles of the greenstone, with the shining, irregular, but angular, patches of white and black quartz and hornblende, commingled with others of a duller white felspar, all which, visibly distinct, enter into the constitution of the granite.*

* Natal granite is a Syenite; a variety in which hornblende is

These varying appearances of one and the same fundamental formation, upon which the whole surface structure of the earth rests, may be presumed to have arisen from the different conditions the ingredients have passed through in the course of the geological history of our planet. It would seem as if an original general granitic crust had been exposed during an immeasurable time to extensive denudation, which had released its several constituents, and that in this state of disintegrated *detritus*, the larger and more insoluble quartz crystals were effectually washed out by the constant surge and roll of a vast superincumbent ocean, upon the shores of which they were ultimately deposited in the form of loose sand, or as beds of stratified stone, in the estuaries of rivers, and along coasts favorable for its formation; of which a good example is seen in the north-western coast of Africa, where a shelving strand stretches out on a gentle gradual incline, for many miles seaward. The quartzose cliffs of Table Mountain, Cape Town, could have no other origin.* On the other hand, the felspar and hornblende, abounding in *alumina*, the basis of clay, and other soluble earths, were carried, in a state of impalpable division, to subside in the quiet of the furthest depths of ocean, into a vast bed of material for a future greenstone, or some other allied rock.

It is natural that the same ultimate constituents, though under different circumstances of combination, should, in the chemistry of nature, decompose into secondary productions, possessing very similar characters, and, accordingly, the soil immediately overlying granite, if it be of a looser and more loamy nature, from the admixture of a certain proportion of quartz particles, possesses the same red or dark brown appearance of the soil, which result from the disintegration of the far more prevalent greenstone. Again, wherever opportunity has been favorable to pre-

substituted for the mica. A considerable proportion of the latter is however also contained.

* The summit of the mountain has entirely undergone the transition into sandstone; and the skeletons of the rocks that have hitherto resisted the ravages of time, are surrounded by myriads of oval shaped and rounded pebbles of semi-transparent quartz, that were once imbedded in them. Those pebbles have acquired their rounded form by friction, when the matrix in which they are still found buried, had not assumed the form and consistence of stone.—Barrow's *Travels in South Africa*.

serve, in some sheltered corner of an old valley, the remains of stratification resulting from secondary decomposition, we find, whether in a granitic or greenstone district, the same arrangement of deposit, both as regards material, and the order of succession; the chief difference observed will probably be in the varying thickness of the strata, sandstone prevailing chiefly where resulting from granitic decomposition, whilst clay beds will predominate where the source is greenstone, or some other member of the trap family.

But before proceeding further, let me be properly understood with regard to the character and operation of fluvatile denudation in Natal. If I am correct in my account of the remarkable subverting influence of every younger stream, upon the bed of its immediate and more elevated predecessor in age, it follows as a natural consequence, that oldest hills must be the mere ruins of former water courses; and the previous deposit in their beds, becoming a closely drained alluvial soil, is liable to be carried away again far more rapidly than the substance of the original rocks around. Few opportunities, therefore, are afforded of observing the permanent results of causes in operation, to assist us in deciding the true geological character of recent formations in Natal. On the coast, and for a few miles inland, we certainly see sufficient to inform us of the nature of changes going on, and in the general surface features of the whole country we may perceive, by a negative kind of testimony, how persistant, through remote time, has been the constant transmutation into each other of hill and valley, as the easily disintegrated material of the seaward slope of the Drakensberg has been gradually wasted away, and slowly conveyed into the neighboring ocean. And as if nature was not satisfied with this rapid process of wearing away the Drakensberg in the wet season, the looser soil, and the abounding but impalpable dust of clay during the dry, are frequently exposed to powerful currents of cold air, descending, by the force of gravity alone, from the summits of the mountains, and sweeping all before it into the sea, with scarcely less power, and much greater penetrability everywhere, than would be experienced from rushing water.

Another remarkable surface condition of Natal materially affects the character of sedimentary deposits, and requires to be mentioned here. I have before said, it

appeared to be the head or "hope" of a large submarine valley, extending beneath the waters far beyond actual observation. This is proved by the drainage outlet of its latest gain on the coast, continually changing its situation to preserve a direct communication with the line of lowest level in the trough like excavation, along the granite bed of which moves slowly a volume of silt and mud, the water-borne *detritus* of the land, first deposited in the estuaries of the rivers, but which gradually descend, by the force of gravity, the submerged incline, into the remotest abysses of the Southern Ocean. A stream of molten lava descending a volcano's side, is no unapt representation of the manner in which this river of soft clay is determined to its final resting place, with a motion somewhat analogous, also, to that observed in the advance of glaciers along the vallies, in those elevated regions which favour their production. The slaty-form nature observed on the lowest stratum of the ice, first suggested to me a somewhat similar origin of effect in the characteristic cleavage of slates, and schist, and shale, the acknowledged result of clayey deposits, under circumstances of extraordinary pressure, though this alone, without the further intense squeezing influence of a superincumbent mass in motion, would not sufficiently explain the peculiar laminated structure of these formations.*

These digressions concerning surface peculiarities are necessarily limited to the statements and opinions involved, without attempting to prove them, beyond pointing to

* "Near the tower of Nant-y-belan, North Wales, is exposed what is considered to be the bottom of the new red sandstone formation. For a thickness of 100 yards, it is full of the *debris* of the older formation from the primary granite to the freestone which interstratifies the coal in the parish of Ruabon. Here and there we find relics of the carboniferous series, and, thinly scattered, a few vegetable and marine fossils, amidst a mass of clunch, and clay, and shale, and gravel; but what strikes us with the greatest astonishment is the huge boulders which lie buried in the mass. Whence came they, and by what agency? Some of them are of immense size, measuring many yards in length, breadth, and thickness, and probably one hundred tons in weight. It is remarkable, too, that their forms are much shattered and worn, as from slow and laborious travelling." This account I had from an eye witness of this strange geological enigma in 1848, and who asked for some explanation. Its solution is evident, I think, if my idea of the gradual descent of vast clay deposits down submarine vallies,

illustrations or parallel instances, which may guide other observers in forming their own judgment upon what they see in Natal. The few lessons they have to learn are of singular interest, and that which will increase the pleasure of the inquiry, is the circumstance that, whatever question is raised, or doubt suggested, in the course of personal examination of the several formations on the spot, will have to be decided by the ingenuity or profundity of the observer himself, for he will receive no assistance from works upon general geology to aid him in arranging, under any known system, a series of clay formations which, whilst they certainly belong to the present age, and are still being produced, cannot be separated from the result of exactly similar operations, that commenced with the upheaval of the continent to its present elevation. In fact the unusual phenomena presented can only be explained, by supposing that our stand-point in Natal, in a geological sense, is such as in Europe might have been occupied at the time of the deposit of the coal-measures, and the new red sandstone, and previous to that great revolution in circumstances and condition of the surface, which is generally supposed to have marked the separation between the secondary and tertiary era of our planet's history, and even then, if an order of succession in time is insisted upon, the modern representative of an antediluvian observer would arrive at very erroneous conclusions, for in Natal I contend we are as well able now, as he would have been then, to form an opinion upon the subject, and we see that all the series of grouped strata, beginning with the new red sandstone, through the coal measures, down to the grits and slates of the old red sandstone, and Silurian system, may be contemplated in cotemporaneous formation, and feel convinced that it is situation alone, whether above or below the waters of ocean, on its shores, or in its furthest abysses, which chiefly influences differences in appearance

glacier-wise, is a correct one, for of course, in their progress, they would collect beneath them a *morrain* of detached portions of every rock they passed over in their extraordinary journey to the lowest depths of ocean, and these commingled ruins of earth's varied crust would be out of all comparison, larger both in weight and bulk than the somewhat similar collections of rounded stones, which accompany the progress of glaciers at the present day, and are received as evidence of their former existence in places where now no phenomena of the kind are to be observed.

and structure of the stratiform rocks belonging to the older, middle, or newer Palæozoic periods of Ansted's System of Geology. Thus all the indications of new red sandstone are exhibited in the present strata accumulating around the basis of the table hills, and on the slopes of the terrace-cut face of the highlands generally; whilst other members of the same formation are being repeated in the drifted dunes and lacustrine deposits of the coast. At the same time coal measures are being deposited in the estuaries and shallows of our seas, in long trough-like depressions, formed by banks of submarine silt, which nature's economy has interposed between the uninterrupted, indiscriminate descent of all fluvatile sedimentary matter into the depths of ocean, and the very careful sifting of the comparatively insoluble constituents, such as quartz, and carbon, and lime, from the more soluble clayey element destined to form, where allowed quietly to bed itself upon the granite foundations of the earth, a new sedimentary crust, of a Silurian character, or, if disturbed by igneous agency, to become converted into simple crystalline trap rock, as I have before suggested.

Isolated granite hills in England, such as Charnwood forest, and the range of the Malvern in Worcestershire, have strata of new red sandstone deposited horizontally around their basis. The same formation is also observed wrapping round the old trap rocks which form the axis of the Vosges range on the left bank of the Rhine, near Strasburg. In these places, and in many more that could be mentioned, the ancient denudation which wore down the primitive granite, seems suddenly to have been suspended, and its last effects covered and preserved by deposits of a newer era, and of a totally different character. Wherever beds of fine siliceous sand, covering a coarse ironstone gravel, all resting upon a stratum of hard clay, and thus alternating for several feet thick, such as surround the base of Table Mountain, Cape Town, there we see, I believe, this new red sandstone in process of formation; nor can the deposit be fairly referred to any other group. In Natal, exactly the same circumstance occurs wherever the fallen *detritus* from the green-stone heights above are protected from rapid denudation, which otherwise carries away both old and new formations, and which, in fact, makes the surface of Natal one extensive excavation, increasing in size every day. And here,

perhaps, is the proper place to recite the order of the several phenomena attending the process.

The first operation seems to be that a thin pellicle of oxydized greenstone forms on the face of the exposed rock. A dull grey colour marks the transition from the dark bottle green hue of the inner texture of the stone, to the ultimate bright red which the barely perceptible film assumes, when fallen clear from its matrix, and entered on an independent existence as a secondary formation. Approximately the greenstone may be said to contain from ten to fifteen per cent. of iron, the oxydizing action of the atmosphere upon which produces the result just described. Accompanying this chemical change is a mechanical increase in bulk, and a greatly increased specific gravity. The denuded greenstone, completely transformed, occupies at least double its original space, and, in so far of course, counteracts denudation, and checks its otherwise rapid effects upon the surface of the country. The disintegration of the rock is further promoted and hastened by the continual wash of condensation which every night, sensibly or insensibly, connects the sources of the perennial streams that take their rise on the summits of every hill in Natal, with the clouds that rest upon them, and that even in the clearest nights seems to rob, by some secret specific influence, the air of whatever moisture it may contain.* Rank vegetation, of a strong wiry grass, also dips its roots, acting mechanically by their growth, and also chemically, in the process of selecting proper nutriment from the rock beneath. Water condensed from the atmosphere sinks through the loosened material, and finds a retreat beneath from the evaporation of day. Here it collects in unseen reservoirs, from whence it issues in a strong stream, wherever the otherwise impermeable virgin rock crops out

* How often, in contemplating this natural operation, which supplies Fort Napier and the town of Maritzburg with water, have I been reminded of the representation, in very old maps indeed, where the sources of the river Nile are placed in a remote country to the south of Africa, and made to issue from a body of clouds, and which, whether figuratively referring to the obscurity of its geographical origin, or really indicative of the character of its water supply by condensation, could not have more appropriately conveyed the idea of a copious and never failing supply of water, independently of rain-falls; a very common error in the middle ages with respect to the climate of Africa, and more especially of its unexplored parts.

on the edge of the heights, from below the surface soil and shaly substratum. Table topped hills have generally a drainage towards their centre, where little marshes form, at the bottom of which a yellowish clay collects, wherein nodules of an argillaceous limestone, studded with little pellets of ironstone, are sometimes found; and this circumstance illustrates another admirable provision of nature so to collect, in a form calculated to be useful to man, the very small proportion of lime (barely one per cent.) in the original greenstone rock. These elevated marshes have much in their character that reminds me of the peat bogs that may be observed in black patches upon the sides of the naked granite in Ireland and the north of England. They extend themselves towards the circumference of the isolated area upon which they lie, and ultimately the weight of moisture contained, after some extraordinary rains, is sufficient to overcome the resistance of the narrow barrier remaining, and they burst forth, an avalanche of loose stones, thick mud, and water, upon the plains below. An instance of this occurred in 1853, in the immediate neighbourhood of the Rev. Mr. Lindley's Missionary Station at the Inanda, to whose kindness I am indebted for the opportunity of observing this interesting geological phenomenon on a large scale, as many thousand tons of the disrupted and fallen material covered an area of at least one hundred acres, and many of the stones were carried to a distance of three or four furlongs from the point of discharge. The amount of such land-slides, indeed, during the year in Natal, is enormous. In the broken country behind the Norwegian Mission Station at Amapamula, I have seen, in one prospect, more than a hundred evidences of recent falls of rock from the face of the kloofs, marked by bare red stripes, where the bush beneath had been torn away in the descent. And where the accumulation of the detached ruins takes place can only be surmised, for it is not allowed to remain long in the narrow vallies, which are exposed to the ravages of occasional floods, that rush with irresistible force carrying all directly into the sea.

Where, however, opportunity is afforded of examining the sedimentary products of recent denudation, as, for example, in some sheltered corners of the plain of the Umgeni, where it meanders in front of the thriving settlement of York, the conclusion is forced upon the mind of its identity in character with the deposits from which have

originated the new red sandstone series. It consists of a dirty, yellowish coloured, loamy earth, containing a small proportion of silicious matter, and abounds in the bed of a rivulet that has formed, at no very remote period, a drainage outlet, near Mr. Otto's house at New Saxony, for the former summit basin of the flat hills to the north-west of Maritzburg town lands. In this deposit it is difficult to perceive any stratification, owing in part to the deep gullies every little tributary rill cuts through it. This is amusingly instanced near the lowest part, where an area of a few acres exhibits the model of every kind of pinnacled fashioned hill the mind can imagine. Towards the bottom of this accumulation, the nodules of lime before mentioned collect in considerable quantities, as if they were being determined into a stratum, and probably would do so, if allowed to remain long enough; but the searching, denuding operation which marks the economy of nature in Natal, if for awhile suspended in such situations, is sure to return with a compensating force of reaction, and sweep away all remains of previous inactivity. It is therefore in the drained sites of previous subsurface denudation, wherever marshy vegetation has exerted through ages extensive transmutary effects, or in the recent lacustrine deposits in the coast district, that we can only expect to examine the geological character such sedimentary deposits ultimately assume.

The agency of a rank vegetation in shallow hollows of extensive plains, is most remarkable, and in its character novel and interesting to the watchful student of nature. The delicate rootlets not only insinuate themselves at every point of advantage between disintegrating particles of the hardest stone, but, exerting a vital reaction upon unorganized matter, still further overcomes the integrity of the latter, and selects and converts its constituents into the proper food for the support and growth of plants. Generally the result of this operation is to accelerate the denudation of surface rocks and soils, the loosened material being exposed to almost immediate removal by the mechanical force of moving currents of air and water. In situations, however, favorable for retaining or collecting results, a depth of soil is sometimes obtained of very considerable magnitude, and not unfrequently, if exposed to any change of condition, sufficiently great to mark a revolution in the state of the earth's surface, a dirt-bed,

as it is usually called, becomes a marked feature as a definite stratum in any future geological section of the country. In Natal, this transmuting operation, effectual as it is in degrading the greenstone and granitic rocks of the higher districts, is most interestingly and conveniently observed in the flats and wooded dunes that stretch a mile or two inland along the coast. Amidst the loose particles of quartz, felspathic sand, and comminuted shells, that form the surface soil, the accidental fall of animal *exuviae* is sufficient to commence an important change in the previous condition. The seeds of grasses and other plants find there a suitable resting place, and during the process of germination resolve into their ultimate constituents the inorganic particles which supply their food. As growth advances, this specific influence of organic chemistry, selecting and refusing, extends in degree, and a circle of altered earth in a few seasons forms around and beneath this centre of vegetable life. The gritty and calcareous sand will be found to have been converted into a fine clay or mud, intermixed with which incipient little lime nodules may be detected upon close observation. Another step in the economizing system of nature under these circumstances, is directed to arrest the otherwise easily removed beginnings of a future firm and fertile soil. A colony of ants takes speedy possession of the new material so well adapted for their purposes, and the spot becomes a strongly agglutinated and cemented mass, capable of bearing large shrubs, which soon indeed appear, and by repeating on a larger scale the eliminating and transmuting processes described, gradually produces an extensive formation of clay when the numerous, and, at first, widely separated points of origin, enlarge and encroach upon each other on every side.

Remarkable as are the changes thus produced, and the apparently inadequate agencies employed in effecting what is really a great geological revolution—a loose sandy soil into a bed of strong marl—if we pursue an inquiry into the origin of the beds of clay, slate, and shale, so general as secondary rocks in Natal, it will be found to be equally curious and interesting. A starting point in the consideration is to be fully convinced that the circumstances under which we are enabled to examine the shale-beds now in process of denudation, are very different from those which marked their original deposit. The little rounded undu-

lations which characterize the low ground on either side of a meandering streamlet that drains the bottom of some prolonged but shallow valley, indicate, by uniformity of summit structure and formation, a former continuity of surface, when, in the state of a nearly level plain or gentle incline, it exhibited all the peculiarities observed in many similar situations, though on a comparatively small scale, still existing in Natal. At the first birth of all the rivers in this singular country, the steady constant force of the easterly winds is sufficient to drift up and obstruct the otherwise natural course of running water on the slope of the Drakensberg; and, according to situation, must have been the extent of the impediment thus produced, and the length of time which elapsed before the annually increasing strength of the growing river at length enabled it to break down all opposition to its descent to the sea, and changed the face of a morass, or shallow lake, into dry habitable land, and ultimately into scenes and situations, of which the immediate neighbourhood of Maritzburg, including its town lands, is no bad representative or type.

Under the circumstances attending the original formation of the shale and clay slate, it must be presumed that the prevailing currents of the atmosphere acted like the resistance of the sea to the uninterrupted descent of all fluvalite sediment into its furthest depths. There, the rolling and beating waves, meet, with neutralizing effect, the opposite coming current of the river water. Along lines of equal power, the suspended sediment in the latter necessarily falls, and forms long continuous submarine banks, at some distance from the shore, and within the trough-like depression extending between, all the varied materials of terrestrial denudation would collect and subside; each separate constituent, well washed and sifted, finding at last its proper position in a series of strata, according to certain well determined and definite laws of order, well understood and acted upon by even apparently inert and unconscious matter.*

In the aërial ocean, again, an analagous mechanical

* In such situations form the coal measures by the slow precipitation from the muddy waters of the comparatively insoluble particles of lime, carbon, silex, and iron. During the same time the clayey elements subside more deliberately, and falling outside of all obstructing barriers, are directed, as I have before stated, into some submarine valley, which channel's earth's crust to the remotest

operation has produced in Natal some allied geological phenomena. On the steep descent of the Drakensberg, where the precipitous face of a succession of heights effectually arrest the strong atmospheric currents from the east, the sand and dust borne upwards in vast quantities, fall wherever the moving power which conveyed them is thus neutralized and gone. Deep hollows, and other irregularities of the original surface of the country, have evidently been filled up from this cause, and converted into uniform level plains, in extent measured by the amount of resistance offered behind by the varying angle of the incline, and the conveying force of the wind bearing upon the situation. Ridges defining limits at different elevations have, as another consequence, been worked up, and which are slightly raised, as compared with the flats that intervene between them and the natural ascent of the basis rock, upon which these new and adventitious formations abut and repose.

The drifted increments, almost impalpable to sight or feeling, are composed of every constituent contained in the more coarsely comminuted sand of the coast, and wherever they subside are also exposed to agencies of change that soon determine into definite strata, the clay, the silecious particles, and the lime contained. The well known aptness of the latter, when applied to arable land as a manure, to sink into a regular bed, about a foot or so from the surface, in a few years, illustrates this separating tendency, and aids to explain the operation. The clayey element, easily soluble in water, descends beneath the lime, leaving above all the particles of quartz to form the bands of sandstone, in such a series of new formations. This appears to be the natural sequence of deposit, and in situations where organic life cannot be sustained, as under deep waters, a great extent of earth's surface becomes encased in a hard arenaceous crust. But on dry land the air-borne deposits are exposed to influences of vital action, such as I have before alluded to, and which produce results very different to those that follow the uninterrupted natural laws of

depths of the ocean, where they are destined to built up the slate and schistoze rocks of the Silurian system. On the other hand, upon the dry land, and simultaneously with these operations, the new red sandstone group is being formed, upon and around, the common mineral source of all these secondary sedimentary rocks.

order in the inorganic world. Thousands of miles of coral reef, the future foundations of large islands, spring up out of ocean's depths from the continuous working of myriads of animalcula engaged in separating from the sea water the minute invisible particles of lime it contains, and re-depositing them with their secretions, in the form to which I refer. In Natal, almost as wonderful a monument of animal labour, and enduring instinct, is presented in the beds of recent clay-slate that fill up the original hollows and depressions of a former disturbed and disrupted surface, such as may be easily imagined, as consequent upon the elevation of the Drakensberg. Vegetable agency acts as crumbling machinery upon solid rocks, or as chemical re-agents decomposing their constituents in the process of eliminating food, but unless seized upon immediately, the separated and freed particles, in a state of the minutest subdivision, are, on the earth's surface, liable to be washed away by moisture, or dissipated in air. To provide against this waste, in an inhabited world, or rather to economise for the use and benefit of the animal creation, in Natal we see almost the lowest forms of life, the "naked worms," engaged as constant carriers between the sub-soil and the surface of the ground, and depositing there great quantities of the finest clay, in the form, as popularly known, of "cleansings." The amount of material thus deposited in the course of the year is amazing, and were it not that after all a large proportion does succumb, and pass away before the contingencies of denudation, the labours of these obscure and little considered agents of great geological changes, would in time amount to formations equalling in extent the parallel phenomenon in coralline seas. As it is I am inclined to believe that most of the clay-slate of Natal has passed through the bodies of the large earth-worms, such as abound in every loose soil. They would seem to collect in a stratum of *exuviae* the constituents of pure clay, which vegetation, in the first instance, has separated from the *detritus* of the basis rock of the country. From the commencement of the deposit every accession of new material has formed for a time part of the surface, and of course been exposed to like influences of a vital character, as we see in operation at the present day. It only requires, therefore, the colonial reader to observe what is passing before his eyes; to measure approximately the amount of the little nodular heaps of "worm cleansings,"

cast out and heaped up among the tufts of grass around him, and then to consider whether the process of building up the formation, or of carrying it away, predominates where he observes, and he will, I think, soon arrive to the same conclusion as myself, of the important part in Nature's great drama played by the insignificant, and apparently inadequate agency of the soft and naked worm.

But besides the wafted particles of foreign origin borne inland on the easterly winds (illustrations of the extent and ultimate transmuting effects of which upon surface irregularities I would here quote, were this strictly a geological work), another source of the materials of the clay-slate formation will be found in the annual deposit of the fine mud from the alternate floods and droughts which divide the year in Natal. Every surface hollow, until filled to an opportunity of discharge for its confined waters is obtained, constitutes a kind of lagoon, wherein the *detritus* brought down from the surrounding heights quietly subsides, each fresh increment forwarding the process by which the bed is raised, and a draining stream enabled ultimately to force its way over the barrier of drift that had previously interfered to prevent its escape to the sea.*

The yearly inundations of rivers in Natal are now confined, except on extraordinary occasions, to petty bogs and marshes, which, however, still mark the birth place of a new source, or the future affluent of some neighbouring stream.† The scale is diminutive, indeed, but seems to

* On a grand scale we witness an instructive instance of these surface changes, in the history of the largest of African rivers—the Nile. Originally all lower Egypt between the cataracts of Syene and the coast of the Mediterranean was such an inland lake. Thousands of years elapsed, and the mud of the inundations, annually deposited, filled the vast hollow, until the required level was gained, to admit of the raised bed of that river to communicate with the sea, previously shut out by an intervening barrier of drifted sand. According to a calculation made in 1721, the land of Egypt was raised forty-one feet eight inches in the interval of 4072 years, which elapsed between that date and the presumed era of the deluge. An old Arab writer, Abmasudi, as quoted by Macrizi, says—“It is the opinion of philosophers and naturalists (alluding to Aristotle. Meteorol. 1. i. c. 14) that the Nile once covered its country, and that it spread itself from the Upper Egypt to the Lower. And that upon the waters retiring, some places of it began to be inhabited, till at length, the water continuing to flow off, by little and little the land was filled with cities and dwellings.”

† Immediately over the hill, Vaal Kop, which forms the highest

illustrate previous operations, which in their fullest extent might, perhaps, even now be observed on the north-eastern aspect of the Drakensberg, which, as the reader will remember, is noticed in Dr. Stanger's original report, as presenting a very decided difference in surface appearance from that of the opposite side of the angle stretching to the south-west. On the one hand, the drifting influence of the dry north-east winds have built up, in the manner I have attempted to describe as formerly prevailing in Natal, a gently sloping ascent from the coast north of Delagoa Bay to the ridge of the Drakensberg; whilst, on the contrary, south of that great inlet of the Indian Ocean, the wet south-easters have channelled and washed away the rapidly denuding rocks upon which they act. At all events we see plainly that the secondary strata here exposed were deposited under very different circumstances than those which mark their removal now, and as, I believe, we have the opportunity of observing the two sets in actual operation, one on either side of Natal, the difficulty of explaining former relations of surface with the agencies of change employed is greatly diminished, and an interesting geological problem satisfactorily solved. My observation in Natal is certainly limited to the course of the Umgeni, and the *scala* on either side, but I shall be much deceived if an examination of the Klip River district, and the other side of the Biggersberg (which intervene between the deep cutting of denudation I am familiar with, and the summit surface of the north-eastern aspect of the Drakensberg) does not supply the wanted links in the evidence, to substantiate my view of the origin and growth of the lowest

part of the ridge bounding the Uys Doorns' farm to the eastward, on the right of the road to Durban, is a convenient illustration of the process described in the text. A small shallow basin has been formed, draining a platform of no very great extent. From all sides, after every shower, the waters flow into it, degrading the slopes, of course, but constantly adding to the deposited mud gradually filling the hollow. At no distant date, geologically considered, where a thousand years are as one day, this little marsh lagoon will break through its lowest barrier towards the south-east, and open up the bed of a streamlet communicating with the Umlass; always providing, that the rapid progress of some encroaching tributary of the Umgeni, creeping up from the direction of Table Mountain, does not, in the meantime, eat so far into the higher terrace of the Umlass, as to divert the, at present, apparently determined course of the future Vaal Kop streamlet.

beds of this system of secondary rocks, the clay-slate, or shalestone of Natal.

Continuing the endeavour to classify in a proper natural system secondary formations in Natal, and seeking for a guide in fossil indications, I would first observe that the great deposit of drifted material forming the long slope from the sea north of Delagoa Bay to the summits of the Drakensberg, on the north-west, would seem to supply all the requisite conditions of origin that could be claimed for the new red sandstone of Europe. The associated strata of marl and clay-slate with the sandstone, and which have resulted from the specific eclectic operation I have before alluded to, of the several constituents in the drifted and deposited materials, each seeking an independent, and some approach to a homogeneous character, is also a correspondence of considerable value, as evidence of a common nature in these widely separated formations, both in time and situation. Of course it may naturally be expected that few fossil remains could be found where constant exposure on a surface, somewhat of the nature of a sand bath, alternately hot and moist, as the sun is above or below the horizon, would so greatly promote the removal by decomposition of animal or vegetable remains. The slow, almost imperceptible progress of such a formation, and the continually agitated condition of the latest particles by the air currents, which distributed them over previous surfaces, would be still more unfavourable to the entombment of operating relics for the benefit of future knowledge, except, perhaps, the trunks of large trees, which would alone offer resistance to decomposition, sufficiently enduring to have a chance of becoming fossilified. All these circumstances now in operation in the Trans Vaal country, and the north-eastern aspect of the Drakensberg generally, are similar in character, I believe, to those which marked the rise and progress of the lowest beds of the new red sandstone group of rocks, as examined in Germany, and found intermediate between the upper coal measures, and what are termed the magnesian limestone series. Its general description contained in *Ansted* is "a coarse incoherent sandstone, generally of a red, but sometimes of a blueish grey colour, alternating with shaly and milacious marls, the whole formation being extremely valuable, both in its mineral character, and in the extent of its development. It passes insensibly into the upper beds

called the “*Gres de Vosges*,” or Vosges sandstone,—there being no intermediate bed of magnesian limestone. The total absence of fossils renders it impossible to do more than obtain an approximate notion of the true nature of the transition from the lower to the upper beds.” In England the same formation is seen more directly in connection with the upper beds of the coal measures, and its first layers contains numerous remains of extinct vegetables, not to be distinguished from those species found throughout the carboniferous system, and these are followed by other beds of marl, associated with thin bands of compact and shelly limestone, just as in Natal we might expect to be the case in the secondary strata of the lowest elevation on the sea coast, where they rest upon, and rise from, the submarine trough-like depressions in which the modern deposits of coal are taking place.

But that which irresistibly forces upon me the conviction of the identity of structural era between present geological operations going on in south-eastern Africa, and that which witnessed the formation of the whole Palæozoic series of European observation, is the correspondence in character of the fossil indications in the latter, with the most frequently formed recent remains of animal or vegetable organisms, in the course of being enveloped in progressing formations, and likely to become the connecting *media* of future minds, contemplating the subject from a stand point in remote time, with the active consciousness of to-day engaged in attempting to realize as distant an antiquity, by similar aids, derived from the great store-house of facts nature provides in the fossil world. A good example of this correspondence will be found in the 4th vol. of *Lyell's Principles of Geology* (3rd edition, 1845) where the reader will find, in Plate x, a representation of the most prevalent shells in the Eocene division, the first *dawn* of the tertiary era, when the existing relations of air, earth, and water, are presumed to have commenced after some great disturbance in the previous economy of nature. All the shells there given belong to predominant species, inhabiting the river estuaries and inlets of the sea on the coast of Natal. In the loose sand of the market place of Durban, or in the mangrove swamp that surrounds the Bay, a stranger to everything written in *Lyell* would, in forming a collection of recent shells, find that the specimens most frequently presenting themselves to his observation, are

members of the same families depicted on the plate referred to, as characterizing the lowest or earliest strata of the tertiary rocks.

So far, therefore, in Natal, we are, as it were, carried over the innumerable geological ages which, in the northern hemisphere, have elapsed, whilst the middle and the modern groups of the tertiary deposits have then been forming.* And besides, Europe has also been exposed during one cycle of countless centuries to many changes of condition, which have severally produced a distinctly classified series of strata called secondary, the representative of which we may seek in vain for in Natal, and which include, according to *Ansted* :—

Secondary	The upper new red sandstone. The Liassic group. The Oolitic system. The Wealden formation. The Cretaceous system.
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The absence of these rocks in Natal prove that circumstances of situation have not there admitted of their formation, the key to which, indeed, I am inclined to believe will only be found in those varying relations of earth's surface, as regards land and water, the geological history of Australia, and the coralline archipelagos of the adjoining ocean, will perhaps afford to some future fortunate explorer.

Resuming the analogy between Palæozoic rocks in general, and the new red sandstone in particular, in the two hemispheres, drawn from the character of fossils in Europe, and the modern remains in Natal, or on its coasts, most likely to assume that condition in future sedimentary deposits, two or three paragraphs must contain all that, on this tempting subject, I dare venture to say, without being drawn into an extensive geological survey foreign to the purpose of this present work. In the recent coal strata exposed on the low cliffs on the beach off the farm Compensation, in the county of Victoria, numerous vestiges of

* Thus enumerated in *Ansted's Geology*, vol. i., p. 92:—

Tertiary	The lower tertiaries, or Eocene group. The middle tertiaries, or Miocene group. The newer tertiaries, or Pliocene group. The superficial deposits of gravel, &c., or Pleistocene group.
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a vegetable origin exhibit forms identical with those found under similar circumstances in England but of far older date. All that I have seen were easily referred to species of plants well known to the fossil botanist, and among which the family *Equisetaceæ* were predominant. But besides this correspondence, the observer in Natal finds in the lagoon-like estuaries, and on the banks of its rivers, the living representatives of those obscure types of vegetation which have long been matters of dispute and doubt in the scientific world. I allude more particularly to the *Calamites*, the most common of the fossils of the coal measures, and which, whether we judge of the form of the root, of its jointed fragments, or the horizontal partitions at the articulations, can be properly referred to no other species of plant than the common Spanish reed, *Arundo Donax*, so universal on all the river banks in the south-east coast of Africa; and none other, from its masses and situation, is more likely, even at the present day, to be the most generally submerged and preserved in deposits now forming. In the great inundation of April, 1856, I saw miles and miles in extent of the broken remains of this plant, in rolled fragments of root, stem, and branch, scarcely exceeding two feet long, that formed banks on the sea coast from fifteen to twenty feet high. Five hundred miles from Natal, off Cape Recief, a vessel at this time coming from Table Bay, passed a floating mass of the same vegetable character and remains upwards of a mile in extent. But it is the peculiar curved root of the modern reed which chiefly serves to identify it with the fossil *Calamite* of European experience, though the resemblance may be followed out in every other detail. In *Ansted's Geology*, page 253, vol. i., will be found an engraving of the *Calamites Suckowii*, to which, if the reader refers, he will find it to be a sufficient representation of the peculiar formed root which characterizes the modern family to which I have just been directing his attention, and of which, indeed, I could not have given a better drawing.

Another very interesting instance of this correspondence between present forms of vegetable life with fossilized remains found in ancient sedimentary rocks, is one which seems to decide the much disputed question as to the real nature of the family of plants to which the *Lepidodendron* of geologists belongs. *Ansted*, in his *Geology* (page 258, vol. i.), says of this remarkable fossil genus, "it appears to be the

most reasonable opinion, and that which corresponds best with the result of investigation, to consider it as occupying an intermediate station between the singular club masses, or *Lycopodiaceæ*, and the great tribe of cone-bearing trees; and that, although in some respects it approximates to the latter type, it possesses still closer analogies with the former, and must be placed among the vascular *Cryptogamus* plants not far removed from the *Lycopodiaceæ* and ferns." * *

" In appearance the cone *Lepidostrobus* resembles the young shoots of pine trees; it possesses a conical axis, round which a number of scales were compactly arranged from the base upwards; but the axis appears to have been soft and pliable, and instances occur in which the cone has been bent almost double without being at all fractured." To many of my Natal readers, no doubt, a very singular looking tree called the " *Nooye-boom*," or young lady's tree, is more familiar than almost any other in the bush. It is distinguished by its light grey slender trunk, some ten or twelve feet high, symmetrically scarred with the marks of fallen footstalks. It has large and curiously divided leaves of a lively green colour, springing in tufts, radiating as from a centre, from the ends of the branches, which also spring in the same umbrella or parasol (whence its fanciful name) fashion from the stem. In botanical language it is called *Cussonia spicata*. But it is the peculiar nature of its soft, elongated, cone-like compound flower, that I wish to direct particular attention to, as it supplies, in my opinion, every requirement necessary to identify it with the *Lepidostrobus ornatus*, as described and figured in *Ansted's Geology*. Around a long axis of pith is closely packed, indeed almost agglutinated together, in spiral lines, from its base to the apex, innumerable small, fleshy, scale-like flowerets, of the size, and somewhat of the shape of cloves, but of an uniform green colour, giving to the whole surface of the cone an appearance of being geometrically divided into a number of rough scales, not unlike what is observed in the familiar instance of a pine apple. The short peduncles of each sessile floweret, constitutes also the pericarp, in which lie concealed two hard three-cornered seeds, of the size of grains of wheat. The length of these floral cones varies from three to five inches, and readily admit of being bent nearly double without being broken.

Besides these two particular illustrations, it requires to

be observed that the fossil vegetation of the lower red sandstone exhibits forms peculiarly its own, but of which many existing representatives are found in Natal, and the south-eastern part of Africa generally. Of these the *Zamias* are the most noticeable, and of which one or two new species have been recently added to botanical knowledge. A small tree, in growth and appearance not unlike the Nooye-boom, and evidently belonging to the same family, but with thick, fleshy, cabbage-like leaves, I have often thought was closely allied to the fossil *Cycas*, whose remains occur for the first time in the new red sandstone. I have not, however, been able to satisfy myself altogether, not having met with a living plant since I commenced this work. Tree ferns of various kinds also abound in Natal. The heads of the small kloofs running into the mural faces of the table lands facing the wet south-west, are sometimes occupied by them to the exclusion almost of all other vegetation; the miniature representatives of vast antediluvian forests which perhaps at one time predominated over the surface of the earth, and supplied those great store-houses of coal we now enjoy, with the material to which they owe their origin. And besides these situations, the woods of the coast district, and the water gullies of the clay flats, have each their own tree ferns, as different from each other, in general appearance, as are the habitats they respectively occupy.

A short notice of the fact that some obscure markings, and very indefinite forms of an extraneous character, observed in the otherwise considered nonfossiliferous clay-slate strata of even the greatest age, have been of late generally considered by geologists to be tracings of the common worm, and which corresponds so singularly with what might be expected under the circumstances, such as I have described as characterizing some recent formations in Natal, that I do not think it necessary to press further illustration on this point,* save to remark, as a telling coincidence, that the only fossils as yet discovered in the clay-slate of Natal, belong to this low form of animal life, the soft and naked earth-worm.

Another interesting observation connected with sedimentary rocks in Natal, is the identity of structural

* See *Edinburgh Philosophical Journal*, for April, 1855, page 368, for a paper upon this subject, accompanied by a plate.

disposition in the materials of clay-slate, whether deposited directly from water, or after having passed through the transmuting agency of exposure to volcanic fires. Greenstone, evidently a crystalline rock, and of presumed igneous origin, decomposes in the same characteristic forms as does the latest indurated shale of the former lacustrine terminations of rivers in Natal.* In situations admitting of the examination of the junction of the two formations, the greenstone appears much softened and disintegrated, breaking into spheroidal masses, the concentric layers of which peel off in succession, and form a stiff yellow clay. At the east end of Chapel Street, Māritzburg, where the sluic runs over a little waterfall some ten or twelve feet high, and also in the cutting near Uys Doorns, on the road to Durban, good opportunities are afforded of observing this characteristic feature in decomposing greenstone, and, indeed, of all the rocks of the same family, granite included.†

But (and let the reader mark this) on the same road, about eight miles from Durban, in the side cuttings of the road between Brooker's place, and the outspan near Cato's jaw-bone, an exactly similar tendency is seen in the very recent clay formation that has resulted from the sediment of the waters of the former terminal lake of the Umgeni behind the Berea. And here, too, we are admitted to an insight into the source of those large boulders of coarse conglomerate or pudding-stone, occasionally met with in this locality, for I have seen them, *in situ*, forming the hard concretionary nucleuses of decomposing spheroidal masses of clay. They consist of rolled fragments of granite, pure quartz, pieces of hard clay-slate and sand-stone, imbedded in what may be termed a greenstone paste, gathered by some mysterious influence around fo-

* The regular polygonal forms a moist clay surface breaks into, on being rapidly dried by a hot sun, and, which must be familiar to every one, is evidently an approach to that columnar form which experiment has proved recent clay strata, like many volcanic rocks, assume when exposed to the action of long continued fire.

† Instances of similar decomposition may be seen in the new cutting on the Durban road, near Clough's. The huge masses of bare granite perched on the side of the hill, and which seem to threaten a speedy descent into the valley below, are the hard nucleuses remaining of this spheroidal disintegration. They testify, also, to a much more extensive development of the granite than at present appears.

reign centres, which originally must have been dispersed through the soft mud, previous to that peculiar segregative process which has here determined particles of a like physical constitution into a stratum of claystone. Hard concretionary deposits in the human body seem to affect a similar structure, and generally form around some foreign matter introduced by accident. Gall-stones, especially of a large size, break up in concentric layers, as also do several of the varieties of *calculi* found in the bladder. Other illustrations of the like disposition in suspended sediment to gather around a solid beginning, is seen in the numerous nodules of clay ironstone inclosing or surrounding a fern leaf, and also of chalk, which generally contain, in a flinty concretion, a shell, or some other marine fossil.

I am desirous of impressing this tendency of structure in some forms of deposited sediment upon my readers, as a high official authority in Natal has described the bed of indurated clay, extending behind the Berea some miles inland, to be the result of an easily decomposing trap rock, emptied during some recent volcanic era, and not, as I hold, a lacustrine deposit, upon which various causes, animal, chemical, and mechanical, have acted to produce those differences of appearance and condition that strike casual or careless observers as being irreconcileable anomalies with other circumstances around them. The nearest approach in character to this formation, familiar to European geologists, appears to be the *loess* described by *Lyell*, as occurring extensively in detached patches throughout the valley of the Rhine, between Basle and Cologne. He calls it "a puverulent loam of a dirty, yellowish grey colour, often containing calcareous sandy concretions or nodules, rarely exceeding the size of a man's head. Its entire thickness in some localities amounts to between two hundred and three hundred feet; yet there are often no signs of stratification in the mass, except here and there at the bottom, where there is occasionally a slight inter-mixture of drifted materials, derived from subjacent rocks."*

It is this general resemblance to the *loess* of the Rhine, that attaches the greatest scientific interest to the sedimentary deposits of Natal, as suggesting the real origin of the former; and as the *loess* is now referred by geologists

* *Lyell's Elements of Geology*, 3rd edition, page 409, vol. iii.

to the era of the new red sandstone, I derive a reflex argument in favour of my views as regards the age and character of the geological period, to which the changes and natural operations at present going on, in the structure and surface appearance of the rock formations in Natal, are to be referred.

However, in submitting my own ideas upon the subject, I offer the only explanation which satisfied me of the origin of that almost universal shaly indurated clay-stone general as a secondary formation in every part of the colony, and resting immediately upon the green-stone rock beneath. And before leaving the subject,—to enlarge upon which is not my present object,—I must further observe that, in whatever way produced, the clay deposits referred to, whether in the form of the older shale and clay-slate, or in the modern lacustrine or fluvatile unstratified *loess*, it must be conceded that we see the remains only of the earliest, or the beginnings of the latest deposits, the rapid denudation of the surface, leaving little or no chance of a medium state or condition being available for examination and research.* It can therefore be easily conceived, if in natural operations going on under our eyes, the absence of fossils, save in some remarkable exceptionable forms, can be satisfactorily accounted for, that this similar characteristic feature of many of the Palæozoic rocks is also explained; and the fact may indeed be advanced as another general argument that little or no change in principal circumstances, geographical or geological, have taken place since the Drakensberg was first raised above the waters of the ocean.

To understand his position in a sanitary point of view, the colonist or new comer requires to be made familiar, to a certain extent at least, if not scientifically instructed in its fullest sense, with the character of the climate and soil of his adopted country. And besides, the particular study of health and disease which I am seeking to lead men to consider, more than they have been hitherto taught to do, requires some preparation to learn how and what to observe; and the sketchy disquisitions I have given on these subjects, are therefore intended as pleasant exercises, which

* I of course confine my observations to the valley of the Umgeni, and its ascending slopes, as high as the terrace level of the Umcomas, to the south, and of the Umvoti to the north.

will perhaps lead some happily constituted minds to entertain even profounder inquiries, and to take pleasure in observations connected with the structure and economy of their own frames; a study of all others most momentous to individual man, and yet least considered, until disease disables, or death brings grief and dismay into the very bosom of his family. My introductory lessons, however, would be incomplete, and their proper application to the particular subject I have undertaken to treat upon unperceived, did I not further digress, and enter upon the consideration of another important section of natural history, which describes the physical character and the genius of those families of man which have hitherto found a congenial *habitat* in this part of Africa, and from which I may draw some inferences of the probable effect of the climate and soil upon a totally different race, which the providence of God has transplanted hither, and who come to the test of the great experiment with all the moral and mental advantages Christian civilization affords.

SECTION 3RD.—*Ethnological observations upon the former inhabitants of Natal: their condition and character.*

South Africa, until the close of the fifteenth century, was a complete *terra incognita* to the Christian world. The celebrated allusion of *Dante*, in his *Paradiso* to the Southern Cross—

Four stars shine brightly there,
Ne'er seen but by the first primæval few,

is strikingly illustrative of this general ignorance, as it has always been quoted as a bold and fortunate prediction of a poetic mind, rather than derived from information he could have received from the navigators or travellers of his time.* The voyages of Bartholemew Diaz, and of Vasco

* This apparently extraordinary instance of second sight admits of easy explanation. *Dante* might have read or heard of the phenomenon in connection with an early festival of the Church, the elevation of the Cross, the origin of which may be traced to the Christians of Upper Egypt and Abyssinia, among whom the appearance of this constellation above the horizon in May was a season of rejoicing. Such devotional reverence was also in perfect accordance with the ancient heathen observances that took place on the rising of the Dog-star, connected as its time was with the annual inundations of the Nile.

de Gama, who transferred the “rich commerce of the East from princely Venice to enterprising Portugal,” placed the question of the extent of the continent of Africa to the southward beyond dispute. Vasco de Gama sailed from Lisbon in July, 1497, having under his command three small vessels, the conjoined crews of which amounted to no more than sixty men. He doubled the Cape, November 19th of the same year, and on Christmas Day his little fleet anchored off the Bluff of Port Natal, and discovered our snug and land-locked harbour. Joy and gratitude must have mingled with the feelings of these storm-tossed weather beaten sailors, as they hailed a temporary respite from exposure and labour, and the ample promise of much needed refreshment the haven seemed to offer. Under the circumstances, and considering the coincidence, “Port de die Natal,” or the Port of Christ’s Birth-day, was a happily appropriate name to give, and was, without doubt, proclaimed with fitting ceremonies,* amidst loud shouts of exulting triumph, and hopeful trust in the future.

Nor, in the case of Natal, have such hopes been sown altogether in the sand. From the first it is pleasing to note the testimony borne by these intrepid mariners, that “the natives were remarkable for the excellence of their morals, and that they kept the law of nations better than the most civilized people”—sufficient evidence of the happiness enjoyed, and friendly offices interchanged during their stay on shore. In native language, too, we find that *Amalunga*, or “good men” (as competent authorities interpret the word), has been the popular designation of Europeans to the present time,† another remarkable proof

* In the annals of early European navigation, every vessel belonging to Roman Catholic sovereigns carried a priest, who duly officiated at the ceremony of bestowing a name upon newly-discovered lands. Hence the predominance of sainted names in geographical indexes. English and Dutch navigators of the same period, I presume on Protestant principles, eschewed all such observances, and generally designated places after their discoverers, or on exactly the opposite principle of irreverence to religion, as in the case of Van Demon’s land.

† It is worthy of remark, however, that these same “good men” of European origin do not seem to have been either the Portuguese discoverers, who made only a transient stay, nor the Dutch colonists of the Cape of Good Hope, but a succession of English piratical adventurers—“rats of the sea,”—who preyed upon the rich merchant fleets that traded between the southern ports of

of the spirit of peace that seems to have rested on the newly mixed people of the land and of the ships; and thus it is that, even at this distant period, by records apparently the slightest and most evanescent, ourselves, their privileged successors, are enabled, as if for encouragement and future direction, to realize the auspicious nature of the first intercourse on the shores of South Africa between the white and black races of mankind. If a companion picture was wanted for the subject of Cain killing Abel,—or what will amount to the same thing, and be of apter character, of Cortes destroying Montezuma in South America, about the same time Natal was discovered,—no better incident could be taken than this salutation of history, and occurring on a spot so appropriately dedicated to the happiest memories of peace and good-will among men, once more introduced upon earth.

But it would appear that from the remotest antiquity the negro race, to which belong the aborigines of Natal, were characterized as the best disposed and happiest of the human family. Vulcan, ejected from heaven, the poet Ovid tells us, fell "among the blameless Ethiopian race;" and when another and still older writer, Herodotus, calls the natives of Africa "the long lived Ethiopians," he bears direct testimony of what would otherwise be a natural inference of the longevity enjoyed by man, where plenty and peace are assured to him. The stu-

Europe and the East Indies. The early history of the Mauritius, and the Isle of Bourbon, consists principally of details connected with the exploits of noted freebooters of *Dutch* and *French* origin, who respectively selected one of these islands as a favorite resort for repairs and refreshments; and frequent allusions to celebrated English privateer captains, with whom Port Natal seems to have been the chosen rendezvous. One of these latter deserves particular mention, as the recitals of a Captain Woodes Rogers, of incidents and adventures in a long career of freebooting, strangely mixed with honest trading among the natives of Natal, to his friend Defoe, is generally supposed to have been the source whence the materials of the celebrated story of Robinson Crusoe were derived. The rescue of Alexander Selkirk from the island of Juan Fernandez, by this same Captain Rogers, was not the only case of desertion of a disagreeable companion upon an uninhabited island, with which he was familiar, as a much more affecting and prolonged captivity of a French sailor on the island of Mauritius, previous to its colonization, was one he must have been perfectly acquainted with.

Itafa Amalunga, or Englishman's flat, is also the native name of the little sandy plain, Durban and its town lands occupy.

pendous monuments of Egypt to this day speak loudly of the quiet obedience of a wisely ruled people, neither impatient of labour, nor of the discipline necessary to systemize its results, and direct it to useful ends. A tender regard for human life, and respect for personal rights, distinguished the social power of a pure theocracy, when priestly legislators, eschewing war, found always something useful or grand for idle hands to be employed upon. The ruined remains of public granaries and water cisterns, even in the smallest cities ; leagues upon leagues of mighty embankments raised, and wide canals excavated to economise the waters of the Nile ; temples of matchless beauty and wonderful extent ; mausoleums towering towards heaven,—

Th' sky pointing pyramid,—

all stand in gaunt mockery of the pigmy efforts of modern genius and enlightenment, and sufficiently testify to the former condition and capability of the very family of man which, "peeled and broken," outcast and in ruins, await their future destiny in Natal. On the other hand, as if heaven directed the band of missionary emigrants who have taken peaceable possession of the land, and are indeed a chosen people, must feel assured in the bright promise of the future, and encouraged in all hope and effort by these references to the indications of former help and aid, the inhabitants of Africa have ever derived from the peculiar nature of its climate and soil ; the conjoint influence of which upon the human constitution, is evidently to foster that divine disposition which unites all in neighbourly love and attachment, rather than the development of selfish ambition, and its consequence, the general antagonism of individual interests in society.

The warlike Zulus, as it is the affected fashion to style the present refugee population of Natal, is an unfair imposition upon public opinion in Europe, with which not unfrequently a catch designation is received as an established and recognized truth. They have no real title to be so considered. The mob of England are brutal—of the continent, sanguinary ; but no proper claim lies therefrom to be considered either chivalrous, or even brave. So with the Zulus—they may be excited to acts of the greatest ferocity, and are easily moved to deeds of blood. Indiscriminate slaughter of old and young, men, women, and children, characterize their marauding expeditions. Yet

it may be safely asserted that their natural disposition is to live in peace, to increase their cattle, and to enjoy the fruits of labour. Directed by interest, the men work as willingly and as persistantly as their women have been known to do. The testimony of every late writer is to this effect, and however much accustomed to the quietness, the honesty, and the strong domestic attachments displayed by the Kafirs in Natal, it is impossible almost for a day to pass over without the white colonists reflecting, with admiring wonder, upon the astonishing social phenomenon exhibited in the several relations established between himself, and the hordes of naked savages which surround him on every side. The misapplication of the word warlike does, however, testify to this, that in the more restless and dangerous elements of human character, the Zulus are pre-eminently distinguished from their tribal brethren, the Amapondas, the Amaquabies, and the Amatonga, who live upon the borders of Natal. And it is also sufficiently matter of fact that the Zulus are, as a nation of very recent origin, the least entitled of any to be considered the aboriginal inhabitants of the coast districts, into which they have intruded, it is said even within the last century, from the elevated table land upon which flow the early tributaries of the Great Zambesi river. Still, as I have have before said, with greater energy, and better temper, the Zulu Kafirs, in their intercourse with the white man, prove that they possess every capability for good instruction and useful service, which promise so much, if properly and wisely directed, in future prospects of human advancement and enlightenment, especially in the dark places of Ethiopia.

Nor is it difficult, directed by disposition and mental character alone, to follow up the fortunes of the native tribes dispossessed of the district of Natal by the intrusion of the Zulus. History, however, is not silent. Steedman, the Swedish naturalist, who visited the Cape Colony in 1831, states that the timid and indolent Tambookie Kafirs on the borders, were the remains of broken and ruined trives driven southward from the neighbourhood of Natal.*

* "The natives partake of the characters of the region they occupy. While the Kafir Proper is a daring savage, warlike by disposition, imposing in appearance, and independent in character, the Tambookie, or Amaytymba, is mild even to timidity: more frail in person, and cowardly almost to imbecility in danger, he is

They represent the once powerful Amatembu tribe, and were probably the inhabitants of this district at the time of Dampier—the description he gives of them agreeing very well with the present Amapondas, our nearest neighbours, to the south of the Umzimvoobo, and whose chief Faku is still the acknowledged and nominally recognized head of all the petty Kafir dynasties that interpose between him and the Cape Colony.

The character and situation of soil in fact makes and moulds the man who possesses it. In the elevated plateau of Central Africa, lately traversed by Livingstone, where for half the year the country is a baked desert of hard clay, and during the remainder an inundated grassy marsh, the breeding and subsistence of cattle is impracticable. Its inhabitants therefore gather in little communities upon favourite but circumscribed spots, cultivated like gardens, and of which the women are at once the proprietors and labourers. Here, therefore, a particular kind of society exists, where man, without congenial occupation, seems to have abdicated his sovereign position in his own family, and remains an appendage to the house, or else, moved by instincts of a less domestic nature, emigrates to surrounding countries, better adapted to satisfy his selfish cravings of distinction and personal consideration, for which there is no room or opportunity at home. Possessed of cattle, for example, which he himself herds, he is independent of woman, except for pastime, but finds no longer the happy security and serenity which accompany the simple wants that can be supplied by a pumpkin garden and a loving spouse. He now wants extensive grazing grounds, and

assailed by the Bushman from the north, by his brother Kafir on the south, by the marauding and predatory tribes from the east, and maintains an uncertain tenure of his native territory: he is kept constantly in a state of almost pauperism; famine frequently stalks with his gaunt form through the kraals of his people; and yet the Tambookie, unlike the Kafir, seldom, if ever, crosses the colonial boundary to abstract any of the numerous herds which feed within his very sight; but when pressed by hunger, or alarmed by danger, he comes in peace, tells his woe-begone tale to the colonist, is fed, advised, and instructed, and returns the friend of the white man. Such has been the state of the relations between our regular colonists and this tribe for a very long period; while that of the southern neighbourhood, civilized and savage, has been one of mutual encroachment and sanguinary contest."—*Steedman's Southern Africa*.

meeting, of course, with opposing interests in other similar natures to his own, Lot and Abraham quarrel as of old, and if the world be not large enough to afford a fair division, might determine right. Thus is laid those foundations of national and political strife, that chief characteristic of society cemented together, not by any real ties of natural love and affection, but by the stern necessity of individuals congregating in union, for the mutual defence of life and property. Even among the most Christian communities the modern received definition of peace, is being in a state of constant preparation for war.

In Natal, and the adjoining coast countries, an intruding population from the agricultural districts of the interior, has so far passed through a transition process, as that from the timid and lazy Bechuana has arisen a race remarkable for energy and decision of character, and were it not that language, and many remaining customs, traditions, and some traces of former social principles still operating, conclusively prove a foreign origin, it could not well be supposed that the Zulu Kafir was of the same kith and kin. Left solely to the promptings and direction of human nature, from a comparatively innocent and happy condition in secluded situations, surrounded by scorching deserts, and where probably, in the first place, widowed mothers found refuge with their helpless offspring from marauding expeditions of hostile tribes, a restless spirit would burn with impatience to realize the traditional legends of the outside world, with which his ears would be filled, and seek, at whatever sacrifice, sure adventure, but uncertain profit, beyond the circumscribed limits of his oasis home. Tales of boundless plains of the most luxuriant grass, and of vast herds of cattle, the property of some one great chief, would be to him as the promise of a far off country, "where milk and honey flow," could he but pass the Rubicon of family love, and by an effort of self-will sever all ties that bound him to his "pent up Utica." Recent gold discoveries in distant and widely separated localities have operated somewhat the same among the sons of civilized man; and thus it is that the greedy desire of wealth seems to sift from centres of comparative peaceful happiness, such dispositions as are not constituted to promote the progress of the Christian dispensation among ourselves, nor the development anywhere of a

social system based upon its first principle—neighbourly love.*

And where covetousness has room to grow, aggression, aggrandisement, and annexation are the natural fruits of the policy it prescribes ; and as man acquires by the strong hand, so by the same means only can he hold his own, as he has a natural enemy in every mean mind that envies his state, and in every honest one that condemns luxurious ease acquired at the expense of others. Hence comes wars and famines, armed truces—misnamed peace—and a general demoralization of the human race, which could only end in some grand retributive catastrophe—a deluge, or other geological convulsion ; and which, indeed, may be fairly presumed to be a reforming agency in a system of moral government of the world, if it be admitted that local situation also moulds human character—a phenomenon in the natural history of mind, not more remarkable or surprising, than that the misdirection of man's purposes or powers should meet with a corresponding correction by some great physical exertion which should alter the whole face of nature, and completely change the circumstances of life that had previously surrounded him.

To return, however, to the oasis formed state of society, where the law-giver of the family is its food provider—the wife or mother—it only requires man to be satisfied with the quiet of home, and the easy even tenor of domestic life, to realize another Eden ; and as the audacious and self-reliant of the rising generation are weeded out by the attractions of prospective hope abroad, under such circumstances a mental constitution is contracted, as distinctive in its amiable and tractable features, as is the generally received very opposite idea of savage nature, fostered wherever opportunity of aggression or impunity for wrong leads men, unchecked, and unmindful of woman's softening controul, to forget the rights of others in the selfish consideration of how best to forward their own interests. But the benign influence of woman, in the secluded and circumscribed oases of the desert, is not the only element

* In Natal, then but newly settled with English emigrants, the gold fever which raged in 1851 is now chiefly remembered by the remarkable clearance it made, with great advantage to the young community, of the idle drunkard, the loose knave, and the hard fisted sordid usurer.

of a humanizing nature operating upon the stern self-will of man. There, as everywhere else, a public opinion is formed, to which individual notions of right and wrong are submitted, as the generally acknowledged standard of social propriety and general good, and as aged and contented men chiefly predominate in such situations, the rights of property, and the value of peaceable possession, have great weight in council; principles, the justice of which the thoughtless and impulsive young can scarcely be said to understand at all.* Without, therefore, any apparently directing influence, a moral education is provided of the first order, inculcating from earliest infancy, honesty, neighbourly love, and respect for the authority of the aged; and if human nature will, in spite of such preparing protection, still develop selfish disposition or self-willed genius, the narrow sphere of home, and the immediate and direct controuling influence of general opinion create a kind of centrifugal disgust that is sure to throw upon the outside world dissatisfied or ardent spirits, before they can have any disturbing effect upon the peace of these little communities.

Nor is it only on the eastern coast of Africa that the native inhabitants exhibit the many promising and pleasing traits of disposition of which we have so convenient an illustration in the Zulu population of Natal. The tranquillizing effect upon human nature of the preparatory social schools I have attempted to describe, as established in the desert gardens of the west,† is observed still operating

* An apt illustration of this principle operating to preserve quiet, and ensure peaceable behaviour in a body of men, is afforded in the general good conduct of the 45th regiment, so long stationed in Natal. An intelligent and observant soldier accounted for it by supposing that, during the fifteen years of its stay, the great majority of the men had advanced in years, and acquired habits of reflection, and some experience of life, the effect of which was that a regimental public opinion had been formed, sufficient to controul the draughts of young men sent out occasionally to reinforce the corps, by discountenancing all excesses, and usefully seconding the discipline necessary to reduce irregular spirits to order and good conduct.

† In Arabian geography, derived no doubt from Egypt, as it appears to be the assumed point of departure, the desert countries to the left of the Red Sea were called generally "the east;" whilst all on the right, as far as the Atlantic Ocean, received the name of "*Mograb*," or "the west." Hence *Morocco* and *Moors* to designate this part of Africa and its inhabitants, in the literature of Europe.

on all sides in the bordering countries of grass and running waters, and which annually attract fresh supplies of unsophisticated good-natured herds, flying from the cruel inactivity of an inoffensive life, ministered to by mothers, and protected as by a sword of fire turning every way to keep off all disturbers of these secure and peaceful solitudes. The golden apples of the Hesperides guarded by a watchful dragon; and man in Paradise, the tree of knowledge, Eve presenting fruit, the serpent, and the Seraphim keeping the eastern gate, convey the idea to my mind that the views I have feebly attempted to depict of the origin of human society, and its primitive state of excellence, were shared in by the poets and sages of the mythological period of profane history, and the priests and judges who transcribed the hieroglyphical records upon which the Mosaic account of the creation is based. At all events it is a singular coincidence that brief recitals, having every appearance of being allegorical pictures of the circumstances professing to be told, should so easily bear an interpretation corresponding in every main particular with the writings of Nature herself on the same subject, inscribed upon the surface of Africa, and in the disposition and character of her sons.

Tribes of a timid and conscientious race, notoriously averse to war and bloodshed, and the dependant property of whatever missionary or adventurer comes among them, hang about the skirts of the desert, occupying the transition tract of country which intervenes between the sand and sterility on the one hand, and the luxuriant pasturage of the slopes and grassy hills of the other. By this time, however, the first descendants of oasis parents have discovered, that the land of hope promises to flow as freely with human blood as with milk and honey. Man has ventured so far in the desire of possessing, as to collect together a few head of cattle and goats. He acquires nomad habits, in search of water and herbage for their subsistence, but in extending his pasturage conflicts with opposing interests, and being unfitted for serious collisions, is driven back, frequently robbed of his children and herds, into nooks and corners of his fatherland, where solitary and secret fountains, few and far between, afford him refuge and a limited support. The social education of this secluded shepherd's life is still favourable to a conformation of human character, marked by an affectionate

disposition, and a reliance upon family love to supply the deficiencies of a precarious and exposed existence. The ties of kindred continue to be the cement of these little communities, but regard for the rights of others, beyond this natural line, has received a severe shock. Pressed by drought and famine, and impoverished by frequent forays of still less scrupulous tribes, so far advanced in the organization of self as to pretend to some degree of civilization, the original child of nature and the desert now finds the retributive cost of discontent, and the danger arising from the possession of property. His sons, too, wanderers by inheritance, and encouraged by their sire's example, soon tire of the privations and poor prospects of home, and early seek existence and occupation elsewhere, generally migrating into the service of some neighbouring uncle, more fortunately situated, and whose political abilities and transcendant selfishness has enabled him to maintain against all comers his rights and interest in the surrounding district, and centered in himself not only the property, but the lives of every individual whom he receives under the protection of his name and arms. One man, so endowed, in a life-time may thus, from small beginnings, raise himself to the position of a barbarian Cæsar or Napoleon. After some such manner it was that Toguh, the great chief of the Amakosi, two centuries ago, thrust out the previous Hottentot population of the present Kafir countries to the south of the Amapondas ; that from the same mysterious north-eastern direction, indicative of a great highway into the interior, came the original leaders of the Zulu nation, driving before them the Amatemba and the Amaponda, who occupied the coast lands of Natal from Delagoa Bay to the mouth of the Umzimvoobo ; and moved by the same spirit, in our own times, Chaka, the brother of the present Zulu chief Panda, made himself terrible to the very borders of the old colony, burning and depopulating the whole intermediate country ; the wretched inhabitants, now called Fingoes, seeking refuge and protection wherever it could be afforded them, or where life was only granted on the condition of perpetual slavery.

Fortunately the life time of the greatest Nimrod the world ever saw would be too short for any material change to be affected by his influence upon the mental character of the unsuspecting, unsophisticated serfs his ability

might consolidate into a kind of society, the second stage of the growth of the tree of knowledge, which, if it means anything, signifies enlightened civilization, as contrasted with the happy instinctive life of inactivity and ignorance their oasis-bound fathers enjoyed in their desert fastnesses. In a century, however, moving causes tell deeper, both upon the human mind and the constitution of the body. I conclude this from some striking incidents preserved in the genealogical traditions of the Kafir chiefs, and which record a succession of successful inroads all from the same quarter, at nearly equal intervals of time, made by hordes of invaders issuing from the sterile and sandy plains of the interior, taking a south-east direction towards the coast through the country now called Natal, where the great natural highway over the Drakensberg afforded easy opportunity to make the descents. It would seem that about every one hundred years the descendants of originally poor and desperate adventurers have systematically, as it were, been made the prey of a fresh irruption of their savage brethren from the elevated north-west. In fact, riches in cattle, and a life of ease, in a fine climate and fertile soil, enervate, in two or three generations, the children of the last invaders, who, by a retributive turn in the wheel of destiny, are thus themselves a temptation, and the victims of a similar inroad to that which placed their sires in the possession of the country. And it is curious to observe how human circumstances in these situations appear to have revolved in the same narrow circle from the remotest times. On the one hand, the desert continually throwing out the surplus population of its confined retreats. Nomad tribes receiving the outcasts, increase and multiply on the borders, where some protection from serious hostile invasion is still afforded by the uninviting nature of the country they occupy. Here, however, the children of the desert do come in contact with the outside world. Hunters of wild animals, and outlawed men, visit their haunts; and a mental constitution, resulting from a long train of social influences, all tending to magnify self, and the last concentration of which is crime, finds itself in front of a very different type of humanity, whose good-natured, unsuspecting simplicity, and non-reliance upon self, offers a field of extensive operations to designing men, and apt opportunity for enlightened avarice or savage ambition easily to obtain a valuable stock-in-

trade, or raw material to supply the contingencies of a warlike and aggressive policy. Tempted or forced into service, these children of nature and the desert are lost in the markets of the world, or become the truculent, because artless, instruments of some dominant self-will, actively engaged in the neighbourhood of their origin, in subduing tribes more fortunately situated, and taking possession of their lands, and herds, and women. On the other hand, let us now suppose the intruders to have established themselves, and enjoying the fruits of the reckless energy displayed. Their flying victims disperse over countries, with the inhabitants of which they have always held friendly relations, or else conceal themselves in inaccessible kloofs and forests. Sometimes driven by the cold neutrality of alarmed neighbours from their territory, not to excite the anger of the conqueror, the wretched refugees arrive in far distant lands in vast numbers, wild with famine and despair, as was the case in 1832, when the previous inhabitants of Natal and the adjoining countries were dispossessed by the Zulu chief Chaka, and found no resting place again, except as Fingoe slaves to Kafir chiefs on the colonial border; and in a field of blood, where an extensive slaughter was made of them by some native tribes, assisted by British forces, before the real character of the invaders became known to the Government. And every hundred years, or thereabouts, so far as may be gathered from traditions, and some state customs connected with royal marriages among the Kafir tribes,* the same road has been repeatedly taken by the degenerated descendants of each successive swarm of adventurers from the great central

* It has been observed among the chiefs of the Amakosa Kafirs who have many wives, that one is always acknowledged highest in dignity and rank, and it is the invariable rule to select this "great wife" either from the Amatembia or the Amaponda tribes. This seems to admit a superiority arising from the antiquity or nobleness of the woman's descent. It certainly agrees with the order in time in which these several tribes have been driven further southward after a term of dominant rule in the favoured district of Natal, by the next succeeding invaders from the interior. The Amatembia of the time of Dampier retired before the Amakosa, who were themselves dispossessed by the Amazulus; and these latter, except the magic circle has been broken into by European civilization, wait for some similar pressure from without, perhaps now gathering in Mosilikatse's country, to be driven away in their turn, and compelled to find fresh homes where fortune or friendship should offer them opportunity to settle.

hive, that have succeeded in establishing themselves in the district of Natal. Large possessions, cattle and wives abounding, and long continued peace, secured by a previously acquired warlike reputation, enjoyed by a people but one or two removes from desert simplicity and privation, is a prosperity in worldly goods which, as usual, proves fatal to itself; for whilst it is favourable to the development of man's kindlier nature, and disposes him in the mass to a wholesome regard for truth and justice, the first rudiments of social order, it ends, for want of enlightened direction, in making him individually a slave to indolence and greedy avarice. His wealth a snare to himself, now becomes the temptation that draws down the correcting scourge of the next invasion, before which he passes away, and makes room for another revolving illustration of man's feeble approaches towards social organization, when aided only by the instincts of his nature, he is placed in favourable circumstances for its animal and physical development, but most unfavourable for the proper direction and expansion of his higher moral and mental faculties. Were it otherwise, and under the influence of Christian principles, an innocent pastoral life, in a happily constituted climate and fertile country, would, I feel convinced, ultimately result in such a consummation of human excellence and happiness, and a state of society so harmonious, that it would be Utopian even to dream of, had we not the evidence of our senses to tell us what divine institutions did once prevail among mankind for hundreds of generations, and which is proved beyond all question by what we see and learn, from the ancient monuments of Egyptian art and learning still remaining to inform, instruct, and encourage us.

The impression made upon the mind, after this necessarily very contracted summary of the principal circumstances which, in and around Natal, have contributed to form human character, and affected the destiny of its inhabitants, is that they are eminently calculated to promote a mental constitution in which the love of selfish ease, and animal pleasure in general, are the prominent incentives to exertion; in direct contrast to that centralizing, gregarious instinct of humanity, the proper object of which is the organization of society on the basis of justice to all, but the abuse of which is the love of power, or the self-will of individuals seeking to con-

troul the opinions, and command the services of others, without any question of their right to do so.* If we look still closer, it will also be found, that the remote cause of these differences, in thought and motives of action among men, so signally displayed in national institutions, and in the specific character of entire races, is of a nature that should occupy the most serious attention of every one sincerely interested in laying the foundation of a new community, and which in a few words may be defined to consist in, that, to whatever condition indolence and sensuality may, and does always, reduce their votaries, it never extinguishes a feeling of conscious inferiority to those of a nobler nature, who refuse to yield to mere animal desires. To these, at all events, a honest respect is paid, and minds of innate goodness, and marked by prudent self-controul, are certain to be made arbitrators and judges in a society of such erring sons of men. Fears of reverse in fortune must ever haunt such dependants upon mere external material good, whilst adversity at once reduces man to a wholesome self-examination, that if not reformatory, will at least be philosophical, and preserve a reverence for the good, the beautiful, and the true, all leading direct to the knowledge of God; in which spirit, and under such circumstances, many of the Psalms of David were no doubt composed, and will serve as instances and illus-

* The epitome of Kafir history I have already given, conveniently illustrates, on a scale adapted for general comprehension, the oscillations of man's condition between these very opposite and antagonistic extremes; and further, the continual circle of barbarism in which he moves, if directed only by the delusive light of his own nature. I have described the Amatemba as having been driven from Natal by the Amakosa, who, in their turn, fell before the Amaquabies. These appear to have become the prey of the Amazulus, who await a destiny to be determined by the success or otherwise of the colonization of this country by Europeans. The revolution of the circle is completed, by observing that the Amatembu of to-day, under the name of Tambookies, having fallen back over the Drakensberg ridge far to the south, merge by insensible degrees into tribes of Basuta, spreading over the so-called Free State. These, as they approach the confines of the desert, are indistinguishable from the Borolongs and Bechuanas, miserable refugees from which, flying from before rapacious and sanguinary foes, supply the distant oases with the first parents of those secluded and unsophisticated families of man, from which I have sought to trace the original descent of the several successive occupants of Natal.

trations of my views, where lengthy discussion is not permitted me. On the other hand, man—proud, ambitious, self-reliant,—including in his wished for possessions the bodies and souls of his fellows; unscrupulous and exacting in his self-will, and unhappy, discontented, and poor, if another have dominion over him—makes society one continual battle-field, where unequal intellects fight out opposing interests; but where the most incapable self-conceit is as sure of success as the most overreaching cunning; for defeat is no difficulty with those who firmly believe that the fall of to-day only indicates a certain rise to-morrow. And if tempted by success, such a disposition in man leads him to greater folly. He will own no superior, and, as all profane history before Christ sufficiently testifies, will even indulge in an insane rivalry with Deity, and in short, outraging nature, completes the picture of fallen humanity, as drawn by St. Paul in the first chapter of Romans.*

* My attention was early drawn to differences in feature and form accompanying mental developments of very opposite character, for in the account of my visit to Southern Abyssinia, in 1842-3, I have the following general observations upon the subject. My residence in Natal has supplied me with the necessary information required to complete the chain of cause and effect, and enabled me to point out the probable influences, moral and physical, which have contributed to produce these strongly contrasting types of humanity:—

“I was enabled to draw, by my visit to India, a very interesting contrast between the women of that country and those of Shoa. Let me compare two extreme specimens, which will illustrate more broadly that which I wish to establish; that important differences in the constitution of the mind are the primary causes of these varieties in human nature; but which have been previously determined by differences in features and form. This comparison will assist me, as truth, I think, is sometimes strikingly demonstrated by widely different contrasts; the paradox surprises and amuses the mind, and its effect in consequence is more permanent.

“We will first, however, cursorily allude to the physical differences between the Indian girl and the Abyssinian, as a kind of introduction to their habits. The former is tall, thin, long-waisted, with an angular configuration of form, her features regular, sharply defined, bright and placid. She is a Circassian with a dark skin. Turn to the Abyssinian beauty, her eyes smile uncontrollably as you look. Her figure is short, plump, and roundly formed, with small, but full voluptuous features, that appear blended together with an infantile expression.

“The minds of both are uneducated and natural: in this circumstance of their character, fortunately for the effect of the comparison, they may be supposed to be alike. But are their

The great moral distinction in the constitution of the two minds as described, is the most important matter here, for in it lies the promise of the future greatness of Natal, and the hope of that enlightened philanthropy which loves to connect a benevolent providence with every momentous event in human progress. Without labouring the subject further, I trust that it is sufficiently discernible that whilst humility, and non-reliance upon self, are the grand characteristics of unsophisticated man, as we find him produced in the secluded and distant oasis, vanity and self-will mark the man of the world, in its ordinary selfish sense. Again, when we find that, in a situation which previous events prove to have been a selected stage for frequent trial in man's transition from one condition to the other, and which has always been lost when the last holders ceased to advance in wisdom and energy of character, what is the natural inference if we see the usual course of events broken, and a new element introduced, in civilized man, qualified by education, and encouraged by an history, which in its progress through ages, foreshadowed a glorious purpose—a grand mission—as if his country had been specially selected from the beginning

dispositions or conduct the same? How very different. The Indian girl has considerable personal vanity, is fond of ornaments and show, and seeks to attract attention by rich clothes, or studied graces. Even in their national attitudinizing, and the alluring naught, repose and quiet seem to distinguish her from the laughing, romping, dress-neglecting Abyssinian, who, to attract notice, affects the child, and endeavours to please by artlessness and simplicity. As lovers the Indian girl capriciously selects one lord, but the Abyssinian would consider this to be petty treason against nature, and a crying sin; she always loves the nearest, and while the eyes of that one is upon her, is reluctantly constant, but considers all engagements quite at end by absence, however short. Our coquettes, tall girls, with thin lips and cold sparkling eyes, always remind me of the Indian beauty; whilst our laughter-loving romps, even in their features and form, seem to belong to the Abyssinian mould, in some measure demonstrating the solution of the difficult problem, of accounting for the origin of those differences in the several varieties into which ethnologists have divided mankind. Among our own acquaintances, under external circumstances exactly alike, nature produces by the mysterious agency of mental endowments, the possible mothers of families of man, which, under different circumstances of situation and of social education, would ultimately present two nations as distinct in every phenomenon of external appearance as are the most opposed specimens of the Circassian or the negro type."

for the development of certain extraordinary resources, to bridge over the otherwise impassable abyss which separates civilization from barbarism. Whilst, therefore, in Britain Providence has set apart, as it were, a human family designed to be an active agent in the great work, in Natal we find Nature—labouring, perhaps Ariel-like, to recover her lost estate—has been as assiduously engaged in preparing a way, and providing the necessary sphere, where moral and physical influences of the happiest kind may unite to produce in man's mental character and moral constitution, that effectual change which will realize all the promises and blessings of the latest covenant made between him and his maker; and ultimately, by an universal regeneration of the race, effect the great object of the Christian dispensation.

No one, I trust, will quarrel with me for the apparently circuitous route I have taken, to arrive at certain conclusions upon the climate and soil of Natal, or will question the firm basis of my opinions on these subjects, drawn from the details of its previous history, and the character and fortunes of its former inhabitants. Its physical excellencies are more apparent, requiring no laboured comments to describe, and the reaction of its luxuriant beauty, and health sustaining privileges upon the human frame, cannot be doubted. Hitherto, however, Natal has only proved a curse, and no land of promise, a temptation to be desired, and a snare when possessed. The civilized people—strangers in the land—who now occupy the country, have yet to show themselves superior to those seductions of a selfish nature, which have always proved fatal to its coloured inhabitants, for the moral of the whole story is the old saw, that “covetousness is the root of all evil.” But there is encouragement in this, that we have no right to expect that the momentous mission in which we are employed will fail. The great feature of the Christian religion is the humility it inculcates as the beginning of every other excellence, and it must be divine ordering, not blind chance, that has brought into direct antagonism (where the agents and the sphere have been both prepared), these opposite radicals of good and evil, with abundant promise and ample light to lead us in the right and proper way. This is the moral of my observations, and not unmoved I thus declare my sense of the duties and responsibilities of our situation in Natal. And my hope is equally high, for no one will

dispute how eminently qualified is the English nation, so advanced in moral, social, and political organization, to be entrusted with the work ; whilst, on the other hand, we have a native population to hear and receive us, which, in its amiable tractability of disposition, and non-reliance upon self, exhibits a very favorable contrast to that of the inhabitants of every other country, civilized or uncivilized, and this opinion, in its broadest sense, seems borne out by the testimony of every missionary or traveller who has laboured or lived among them.*

One of the last and most intelligent observers thus sums up a few remarks, contained in the *Natal Journal* for April last, upon the native character, with which we in Natal are more immediately concerned :—

“ The Zulus of Natal belong to the race of men that the large experience of Dr. Livingstone pronounces to be eminently endowed with the same faculties and tendencies as Europeans. They are a rude but not an abject people. If their intellectual and moral powers be measured with those of the analogous element of any white community—that is, with its untutored and uncultivated masses—it will be seen that in these particulars at least they can very well stand the test of comparison. Like the rest of mankind, they comprise a mixture of good and of evil within themselves, and they need for the development of their highest phase of character, that the good should be led out and strengthened, and the evil placed in abeyance and under rule, by the applications of education.”

* “ I was much affected, a few weeks ago, when Mrs. Wilder was very sick, and I was daily fearing that she would die, by the frequent visits they (the heathen of the neighbourhood) made, to inquire about her, and to comfort and sympathise with me. Heathen though they were, they would talk to me of God’s mercy, of His sovereignty and power, of my duty to trust Him, because he would do all things well, like ministers of the Gospel. One day, when my own heart was almost bursting with fear and sorrow, and with rebellion against what God seemed about to do, four men came, and talked so piously, and repeated so much of what I had told them in my sermons, as also of what I had said to one of them who had been sick, that I could not have been more surprised, had an angel from heaven appeared, to reprove, and strengthen, and comfort me. And yet these were naked, filthy, heathen ! I wept, and felt like covering my face, and bowing in the dust before God, who thus spoke through them to me in my loneliness and anguish.”—*Rev. Mr. Wilder to Board of American Missions.*

To this agreeable picture of sympathy and humanity, so different

I need not say how much the opinions here expressed are in accordance with my own ideas upon the subject, and which I would gladly have extended, had I the opportunity of referring to necessary authorities when required, and the want of which has proved a great difficulty. The range of a good library would have enabled me to indulge in chapters where I have been obliged to be content with pages, and however satisfactory it may be to my readers to escape the infliction, I must be excused one groan over many dissolving pictures of my imagination, which arose in the course of my work, and gave me pleasure by their vivid likeness to truth, but departed before I could verify and fix them. I could not afford to be set down as a mere dreamer, or it would have been easy to have added considerably to my observations in connection with physical influences telling upon the moral and social economy of man; and on the remarkable pointing, as it were, in the colonization of Natal, of two distinct histories, widely separated in time and place, but working in divine accord to a destined and foregone conclusion with regard to human progress, and the means by which it should be carried out.*

from what is generally received as characteristic of a barbarous race, I shall append an extract from *Livingstone's Travels*, p. 341, sufficient, I hope, to show what mistaken ideas the greater proportion of the civilized world entertain of their supposed less fortunate brethren in the interior of Africa. At all events, heathens they cannot be who could be influenced by such reasoning as the following :—

"They denied saying they wanted the customary tribute only. I asked what right they had to demand payment for leave to tread on the ground of God, our common father? If we trod on their gardens we would pay, but not for marching on land, which was still God's, and not theirs. They did not attempt to controvert this, because it is in accordance with their own ideas, but reverted again to the pretended crime of the saliva."

* After this chapter was written, and actually in the press, whilst perusing *Livingstone's Travels through Africa*, I fell upon the following picture, drawn from life in one of the desert retreats, where innocence and happiness still linger, if they may be said to dwell upon the face of the earth at all :—

"How often have I beheld in still mornings, scenes the very essence of beauty, and all bathed in a quiet air of delicious warmth! yet the occasional soft motion imparting a pleasing sensation of coolness, as of a fan. Green grassy meadows, the cattle feeding, the goats browsing, the kids skipping, the groups of herd-boys, with miniature bows, arrows, and spears; the women wending their

And as, in drawing to a conclusion my observations upon the general character of the native inhabitants of this part of Africa, I have quoted one scientific authority (Dr. Mann) in support of them, I shall now also endeavour to corroborate my favourable judgment upon the climate and soil, by appending to this chapter the following striking, but very natural, burst of wondering exclamation on the subject, made by the traveller Steedman, writing in 1831, long before any idea of the colonization of Natal was entertained, premising that the scientific visitor to whom he alludes is the present well known and respected Inspector General of Hospitals in the British Army, Dr. (now Sir) Andrew Smith, who, in his younger days, was an enthusiastic explorer of the east coast of Africa :—

“ Does the fabled ‘Lotus’ grow in this portion of Africa, of which all who have eaten desire to remain, and all those who have roamed from its feast pine to return ? Is there a *maladie de pays*, a sickness not of home, but for a foreign land, generated by the atmosphere of this clime,

way to the river, with watering-pots poised jauntily on their heads ; men sewing under the shady banians ; and old grey-headed fathers sitting on the ground, with staff in hand, listening to the morning gossip ; whilst others carry trees or branches to repair their hedges ; and all this flooded with the bright African sunshine, and the birds singing among the branches, before the heat of the day has become intense, form pictures which can never be forgotten.”

In the literature of the most ancient people of classic history, the voyage of the Argonauts, was considered to be the oldest description of the earth extant. In this is contained an account of the Hyperboreans, a people inhabiting the sacred islands of the west, and which are none other, in the opinion of the most eminent classical scholars of the present day, than the British islands. The description given of the people and their condition in *Orpheus's Argonautics*, as translated by Preston, seems a close poetical reflection of the sweet pastoral scene taken from *Livingstone* ; and the relationship that can be traced between the present inhabitants of Britain, and the happy Hyperboreans of antiquity, will give additional interest to the following extract from Mr. Preston, vol. iii., p. 24 :—

“ No thoughts of food, nor other cares and toils which molest the generality of men, breed in them the least solicitude : on sweet and fragrant herbs they feed amid verdant and grassy pastures, and drink ambrosial dew—divine potations ; all resplendent alike in coeval youth, a placid serenity for ever smiles on their brows, and lightens in their eyes, the consequence of a just temperament of mind and disposition both in the parents and the sons, *disposing them to act what is just and to speak what is wise.*”

barbarous only as respects its inhabitants? or why is it that no one individual, whatever the circumstances which have thrown him upon, or directed his steps to this land,—trade, science, or misfortunes,—but seems enraptured with the natural beauties of the country? The wrecked mariner, even while despairing of returning to his civilized home, has not withheld his meed of praise; the adventurous trader, searching for his profit thus far from home, has expressed a frequent wish that this was “his own, his native land;” and the only scientific visitor to these regions declared a wish to live and die there. There must be certainly something extraordinary in a country, to call forth so general a testimony in its favour.”

CHAPTER III.

Second division of subject:—The *support* of human life—organs—functions. The head—nervous system generally. The chest—lungs—respiration—heart—circulation of the blood. The skin—perspiration—animal heat. The abdomen—stomach and alimentary canal—liver—spleen—kidneys—uterus or womb. Nutrition—secretion—absorption. General remarks.

After the pleasant and interesting subjects we have just been considering, the reader will find the present chapter a valley of the shadow of death, as compared to the fair and sunny land of Beulah. But some machinery is necessary in all manuals or hand-books to bring within the compass of ordinary knowledge many facts and truths of dry economic detail, to elicit and demonstrate which generations of gifted individuals have been employed, and whole libraries written, to discuss and promulgate. My description here of the general anatomy of the human frame will be of this summary and focal character, now collecting upon a little but important point all the light I can throw, and at another time illuminating as large a surface as possible with perhaps very scanty means.

The *support* of human life is the purpose of the human frame, one of the many forms of the material and visible universe, which exhibits an ever-changing circumference of mortal individualities revolving around a divine centre always the same—the source of all power, all knowledge, and also as reflected in the numerous special provisions, not only for the development, but the enjoyment of human reason, of all wisdom and love. Galen considered the anatomy of man as one continued psalm of praise to his maker, and in its revelations of design, and wonderful adaptation of means to required ends, found ample comfort and assurance in his dependence upon God. It is in vain to expect at present any general adherence to such an

enlightened spirit of devotion, but where it is generally admitted that the proper study of mankind is man, and when we know the author of Christianity recommended his doctrines to selfish apathy and indifference by healing disease and restoring life, public opinion, it is to be hoped, will gradually be saturated with the conviction, that a practical knowledge of the human frame is the surest road to the proper appreciation of the highest moral truths. A sound mind in a sound body is a maxim as old as the hills, and as nature, in diversity of climate and situation, seems to have provided so many schools for reason to exercise its fullest powers in curious inquiries and attempts to explain local peculiarities, and as the reward she holds out for industrious research is improved means of health, and promise of length of days, what further is required to recommend as part of general education, the acquirement of a sufficient knowledge of anatomy, so that the rising generation may take practical advantage of, or apply to individual relief, the results of properly trained observation. Had human progress already reached this point of enlightened condition, there would have been no need here of the descriptions I am about to give of the several organs engaged in the support of human life.

The first natural division of animal economy is into—what relates to organs, and—what to functions, and the reader's attention cannot be too early directed to the important distinction to be observed in referring vital phenomena to either of these sources. Appearances may arise in parts where the usual relation of cause and effect cannot be insisted upon, further than to admit that situation, and the order of sequence, seem to imply it. Unlike mere material existence, where the attraction of gravitation predisposes to a state of rest or repose, vitality may be said to be a law of action as constantly directing change of condition. It is a centrifugal operation, maintaining an experience in direct opposition to the centripetal influence exerted by the ordinary laws of nature; superadding, as it were, to a result obtained, the otherwise non-essential effect of reaction, by virtue of which it becomes an agent in reproducing similar phenomena to itself. We see, for example, in a machine made by hands, that the designed operation goes on only whilst the motive power continues to be supplied, by some interference distinct from either the work done, or the material employed;

but in the human body the cause of action is inseparable from the result obtained, and, indeed, is of such a nature as alternately to reverse the apparent relation of cause and effect; for it is difficult to assign dependence to either element,—predisposition or excitement,—observed in vital action. And it is the question which continually arises from this interchange of causation, as it may be termed, in all the processes of life, that makes disease so obscure; the most experienced practitioner, in a constitution the best known, being frequently unable to decide upon the real character of the disturbing influence, or to say whether the symptoms observed are due to functional disorder or organic disease.

The solution of the difficulty lies in a few principles connected with the *support* of life, which, after all, are easily deduced from its developments in the vegetable, animal, and human forms. Inorganic structure is simply matter determined by gravitation, and arranged according to kind by chemical affinity, and may therefore be said to be so far influenced by vitality, as to be conscious of its proper place in a system of order. Matter thus subordinate becomes further subservient when called upon to supply materials for the support of an organic economy, embodied in individual forms. Vital development requires a physical frame, and this, necessarily the connecting link between mind and matter, is best observed, or perhaps I should say may be better understood, by reference to a self-supporting process, general throughout animated nature, and usually called nourishment. This is the great function of organization, and designed for the material exhibition of an experience and a history which, really of a moral and spiritual nature, would otherwise have no exponent for the benefit of other individualities; requiring some species of education in their transition state, from the darkness of self, and the latent capability operated upon by gravitation, to the illumination of divine love, and the active benevolence of deity supreme.

Nourishment involves a consciousness somewhere of what is proper for its purposes. We find it selecting material, conveying to a specific destination, and expelling naturally, all the various constituents of the human body. And what is done in the complex system of man, applies to the very lowest forms of life. The employment of matter capable of measurement is plain enough and evident

to the senses ; but another element, subtle and active, and linked with solar heat and light, defies the application of any appreciable means to reduce to material demonstration. Its absence or presence, indicated by the so-called negative or positive conditions of bodies, seems to be the great fact which determines all operations and effects of a vital character, and marks its importance as the master and director of mere ponderable matter.* This is electricity, and beyond being a mere platform or instrument, the human frame may also be safely affirmed to be a powerful electric machine. All its subordinate functions depend upon the incessant operation of this principle of excitement, and without it their particular seats, the various organs, become corrupting masses of dead and inanimate matter.

Nourishment also involves the taking from earth the constituent atoms of the human frame; and these, lifted out of the influence of ordinary laws, pass through an experience, active and potent in life, to be resolved again in excretions to their original nature ; and as the process in all its several stages is accompanied by a sensible development of electricity, until it can be better shown what vitality really is, it will be useful to admit this subtle element to be its practical exponent, and the exciting cause of all those phenomena of life, not reducible to actual material demonstration. At all events, that electricity and the nervous power are one and the same, I am satisfied myself. From the electric eel so long exhibited in London, Professor Faraday both fired gunpowder and decomposed water, as

* One exception to the rule may, however, be allowed, though I do not admit it myself. That is the measurement of the time elapsed in the passage of electricity from one distant point to another. But I think duration is of the nature of an operating effect rather than a material result. The time the sensorium is in being affected, might be merely a measure of the effort it makes to be sensible of the presence, in which case the intermission observed ought to be attributed to limited organization, not admitting of closer or quicker communication. A mass of ice making all things colder around it, does not radiate cold like a hot cannon ball does heat. But the diminished temperature is not the less a fact because explained by the circumstance that surrounding objects communicate to the colder body a portion of their warmth, and so lose heat. Here a duration of time must intervene before the effect could be produced, yet this could not, I think, be properly considered as a measure determining or demonstrating the actual material existence of cold.

with an ordinary electrical apparatus. The organ chiefly engaged in the operation was also found to be part and parcel of the cerebral system, being connected with the brain by very large nerves as compared with those distributed to any other part. It seems to be a kind of reservoir of the nervous power, for economic purposes, adapted to the circumstances and situation of the fish, through which it acts directly by a benumbing shock, instead of striking indirectly by exciting muscular action, as in other animals, when the leg, for example, is alternately contracted and projected in a kick, or as the jaw is analogously affected in the act of biting.

A similar economic development in man is observed, to a certain extent, in the purposes attributed to certain little bulbous enlargements in the course of the great sympathetic nerve, especially in the vicinity of the several viscera of the trunk, to which this nerve, a system in itself, serves as a subsidiary brain. These ganglions, as they are termed, are considered by anatomists to be reservoirs of nervous power, and a specific provision by which the continued action of the involuntary muscles (over which the will has no power), such as the heart, the muscular coat of the whole alimentary system, &c., is sustained during sleep, and under some circumstances when death would otherwise seem to have terminated life. For the sake of illustration, it may be mentioned that, by this extraordinary interference, the pulsations of the heart will continue for a considerable time after the head has been cut off; in some animals even for many hours.*

To return to the general subject—if a taper be lighted, combustion requires a constant supply of air and wax to

* To these remarks it may also be added, that the experiments of Matteucci (to whom was awarded a few years back the Copley medal of the Royal Society) establish the following facts—that electricity is equal to fulfil all the purposes of the nervous power; that living muscular fibre is the most sensitive of electroscopes; and that there is an electric discharge in all the muscles at the moment of contraction. Liebeg, the great continental chemist, it seems, has arrived at the same conclusions, for he says—“Vital force unites in its manifestations all the peculiarities of chemical forces, and of the not less wonderful cause which we regard as the ultimate origin of electrical phenomena.” It is also sound philosophy to presume that nature would not provide any second agency, when she is already possessed of one equal to all her requirements.

support it; and in a like manner is human life nourished and sustained by air and the circulating blood. Exactly the same changes are observed in the operations; carbon and hydrogen being evolved from the wax whilst burning, and from the blood in respiration, and in both instances are converted into carbonic acid and water by combination with the oxygen of the air. And lastly, what may be termed the vital phenomena of heat and electricity are alike the products of combustion and respiration. It is in the makers alone the grand difference consists, for could man have added to the taper a mechanism to reproduce the wax and continue its form, he would have created a living thing, and the self-supporting process would have been very properly called nourishment.

Connecting the functions of the body with its organization, is the blood; the vehicle and distributor throughout the frame of all its various constituents—æriform, fluid, and solid,—besides being the theatre of all those chemical changes during which the vital phenomena of heat and electricity are evolved. The particular action here alluded to is observed in its simplest form during the fermentation of malt liquor. The grain being mashed, the sugar and starch it contains are dissolved in the hot water, and exposed at a certain temperature to the air. A very lively internal action soon ensues, attended with a considerable evolution of heat, increasing twenty degrees or more. During incubation, again, an analogous but more complex operation takes place. The air contained in a cell within the egg, under a given temperature, enters into chemical union with the other constituents, developing at the same time heat and electricity. The germ of life thus stimulated and excited, its structural endowments are called into action, and the latent embryo becomes a living chick, deriving nourishment from, and assimilating with itself, all the various substances which surround it.

After separation from the parent, the warm temperature and support of the body is maintained entirely by the chemical action of the air upon, and the nutriment, derived from without, which is contained in the blood. In respiration the air, brought in contact with the blood, becomes decomposed. It enters the lungs a mixture of oxygen and nitrogen, in the proportion of one to four; the escaping breath, on the contrary, consists of carbon acid gas, watery vapour, and a remaining portion of the nitrogen. The

blood likewise undergoes a notable change—dark blue when it comes from the heart to pass through the lungs, it returns a bright red to be circulated through the frame. In the process it has given out carbon, and absorbed oxygen, having exchanged a deleterious poison for a vivifying element; and of such primary importance to life is the whole operation, that respiration suspended for a few minutes, and the individual is lost.

The source of the carbon must be looked for in the food taken into the stomach, and this introduces the subject of nutrition generally, upon which the elevation and structural economy of the body chiefly depends. The production of natural heat—another of its important functions—must not be overlooked, as the food supplies the fuel for that slow combustion, which resolves the crude matters received in the stomach into the chief ultimate elements of the bodies of men and animals—namely,—carbon, hydrogen, oxygen, and nitrogen.* These four, be it also observed, in combination with each other, in certain proportions, constitute the proximate products of the vegetable kingdom—starch, sugar, oil, and albumen; all of which unite in the composition of milk, provided by nature for the young of all the *mammalia*, and is justly considered, therefore, as the type of a perfect aliment. From this, also, it would seem that to plants is assigned, in a divine economy; the task of providing, in the first instance, the chief alimentary principles contained in the blood of animals, there to be transformed by a higher vitalizing power into fibrine, the source of muscle, fat, and the structural basises of all other tissues required to build up the frame.

* "To those who are unacquainted with the principles of chemistry, it will be a startling announcement, that all organic matters, whether animal or vegetable, are composed essentially of the same elementary principles; and, moreover, that these principles are only four in number, namely, oxygen, hydrogen, nitrogen, and carbon. The two first of these gaseous elements are the constituents of water; nitrogen exists in the atmosphere, in conjunction with oxygen; and carbon is the impurity of the air exhaled from the lungs during respiration. Thus, in the air which we breathe, and in the water which we apply to our commonest uses, these four essential elements of everything organic on the face of the globe, these four constituents of ourselves, and of our means of life, are present, as almost sole components."—*Erasmus Wilson on Healthy Skin.*

A great difference, however, exists between muscle or flesh, and fat, which requires some notice. The latter contains no nitrogen, whilst in muscle is found as much as twelve per cent. of this essential element of the atmosphere, constituting, as it does, four-fifths of the air we breathe. Nor can it be derived from the vegetable kingdom, as plants, on the average, do not contain more than one per cent., whilst sugar, starch, and such concentrated products, have none at all in their constitution. The question, whence it comes into the body, lies, therefore, between animal food and the external air, and when we find the greatest proportion of animals, and those of the largest bulk, such as the elephant, hippopotamus, and cameleopard, deriving their huge fleshy forms entirely from vegetable food, we have no other resource but to infer that the nitrogen required is supplied by the air. Muscle, indeed, exposed to constantly flowing moisture, as in some damp burial grounds, is converted into *adipocere*, a fatty substance, so transformed by the escape of the nitrogen in gaseous exhalation. On the other hand, exercise in the open air seems in the living body to assist materially in the process by which the nitrogen of the air is made to assimilate with the other constituents of the blood to form fibrine, the basis of flesh. Stall-fed animals become enormously fat, whilst their wild congeners of the forest or the heath are as proportionately muscular and free from fat. The development of muscle in labourers,—for example, the arms of smiths and sailors, and the shoulders of porters,—also illustrate this specific influence of exercise (no doubt by increasing respiration both by skin and lungs) in reducing the nitrogen of the air into a constituent of the blood.

Besides the four ultimate elements—namely,—carbon, in the proportion of fifty-two parts; hydrogen, seven parts; nitrogen, fifteen; and oxygen, twenty-one; the blood contains minute quantities of soda, salt, iron, lime, sulphur, and phosphorus, all derived from nutriment taken into the stomach, and essential to animal organization. Water is a very important constituent, amounting to four-fifths of the weight of the blood, and is the direct dilutent of the *pabulum* of the frame, by which it is made capable of circulation and distribution. Blood, indeed, is nothing less than liquid flesh, with a few salts superadded for specific purposes in structural economy; as, for example, lime for

the bones, soda for bile, and phosphorus for the substance of the brain. And surrounded, as animal bodies are, by an atmosphere constantly varying as regards temperature, and the quantity of moisture contained, it is not surprising to find that the amount of water in the blood is liable to frequent change. Common experience shows that vapour freely exhales from the lungs and skin, and it can be as easily proved, that under some conditions the body will absorb moisture as readily from the air. From experiments, carefully made, it seems that under ordinary circumstances nearly three pounds of water pass off from the skin and lungs daily, besides what is discharged as urine, and which amounts upon the average to two pounds during the same period. On the other hand a jockey, reduced in weight by abstinence and exercise, after drinking a single glass of wine, acquired not less than three pounds additional weight, which could only have been derived from the atmosphere.

Microscopic examination has discovered in the blood innumerable little bodies of two distinctly different characters; one, coloured, called the *blood-disc*, or *blood corpuscle*, so minute that it has been calculated that "a grain of sand is above a million times the size of one such globule;" the other, a *colourless corpuscle*, much larger than the disc, and seems to be a vesicle containing several spherical granules, imbedded in a kind of gelatine. Whilst the blood-discs serve some important purpose in the changes that occur during the circulation in the lungs (being observed to have *biconvex* surfaces when the carbonized blood is brought from the heart, and to become *biconcave* after its oxidization by contact with the breathed air), the colourless corpuscles are generally considered to be organic entities, and the probable source from which the several tissues of the frame derive their substance.* And here I may remark, as closely connected with the subject, that muscle or flesh was long considered to be the product, not of one of the solid constituents of the blood just described, but of a peculiar substance which, separating by

* The recent experiments of a French *savan* (M. Brown Geuard) show that blood from which these colourless cells have been abstracted, absorbs only one per cent. of oxygen, whilst, containing them, it takes up from ten to fifteen times that amount, proving that the cells are the carriers of oxygen in the system.

coagulation, could be washed out in filaments of a white elastic character, and which, by an *ad captandum* reasoning process, was hastily concluded by early physiologists to be identical with muscular fibre.

So much for the constitution of the blood, resolved shortly into its remote and proximate elements, and with which my readers must, *per force*, be satisfied. As drawn from the body, it exhibits a red fluid, that separates, spontaneously, on standing a few hours, into a yellowish liquid portion, called the serum, consisting of water, and containing several soluble salts, earthy and alkaline; and, into the clot, a coloured mass of coagulated fibrine, the *debris*, or ashes, of consumed muscle or flesh. Taken from a vein, the blood is of a deep purple colour, but issuing from an artery, the stream is a bright lively red, and as the cause of this difference in appearance is involved in the grand vitalizing function of respiration, I shall proceed to describe its organ, the lungs, which will afford me other opportunities of further illustrating the important nature and purposes of the blood.

The upper part of the trunk is a bony basket, the bowed ribs being united in front to the breast bone, and jointed behind to the articulating processes of the vertebra or bones of the back. The broad bottom of this basket, contracted at top where the head and neck rise from it, is formed by the midriff—skirt or diaphragm—a thin but strong muscle, stretching across, and effectually separating the trunk into two proper cavities, the chest and the abdomen. The *lungs* contained in the chest are two deeply divided masses or lobes of a light spongy structure, hanging from, and consisting of, an almost infinite subdivision, and the terminations of the branches of the windpipe, respectively called bronchial tubes and air cells; and lastly, also, of the blood-vessels, dividing into innumerable capillary, or hair-like tubes, distributed over the surface of the air cells; the thin coats of both being permeable to air, the blood and atmosphere are thus brought into almost direct contact.

The *heart* is also contained in the chest, lying diagonally across the left side, its base turned upwards and towards the back-bone, and its point being felt pulsating in front between the fifth and sixth ribs. Like the lungs, the heart is a double *viscus*; each of the two halves being a hollow muscular organ, fulfilling the offices of a forcing and

sucking pump, and presiding, one-half over the circulation in the lungs, the other, over the circulation in the rest of the body. Alternately dilating and contracting, its action is attended with considerable force, pulsation being caused by successive jets of blood, first sucked into the vacuum formed by dilatation, and then expelled from the heart by the force of its contraction. This action is synchronous with the pulse felt at the wrist, and varies, according to age and constitution, from 150 beats in a minute at birth, to about 65, the minimum healthy pulse of mature age.

The heart, though a double organ, has four chambers, two on the left, and two on its right side; but there is no communication between the two halves, except that which is described by the circulation of the blood. Between the chambers, however, on either side respectively, an aperture exists, closed by valves, which permits the passage of any fluid contained in one direction only. Proceeding, for instance, from the left chambers, the blood, by the muscular contraction of the heart, is propelled through a system of elastic tubes, called *arteries*, to every part of the body, where they terminate in minute tubes, the *capillary* vessels, from which commence the *veins*, the returning channels, and which convey the blood to the right chambers of the heart. But this is only one part of the circulation; a second and shorter circuit through the lungs takes place when the blood, arrived in the chambers of the right side, in the state of an impure and dark coloured stream, is forced through another set of arteries to the capillaries of the lungs, and from these latter received into veins which convey it back to the left chambers of the heart; having thrown off its carbonic acid and water whilst exposed to the ventilating office of respiration, and having again become charged with the necessary supply of oxygen, it is now fitted to resume its current through the general system, and perform the functions of the greater circulation. This is the only way a transit between the two halves of the heart is effected, except under extraordinary circumstances, when a large opening (provided for the purposes of foetal life) in the dividing *septum* sometimes remains unclosed after birth.

From the contents of the chest, to proceed to the consideration of the skin, is a natural transition, although so widely distinct in situation and character, inasmuch as that the skin may with propriety be called a respiratory

organ, as well as the lungs, for the blood circulating through the capillaries of the surface of the body, exhales therefrom carbonic acid gas, and absorbs in return an equivalent portion of the atmosphere which surrounds it. In the skin, also, the blood is purified of certain particles, acidulous or saline, but principally watery, which exudes in perspiration—a most important function, that regulates the temperature, and moderates the excitement of the system when exposed to sudden or extreme changes in the external air. This is accomplished by the aqueous exhalation of both skin and lungs, acting as a conductor of heat and electricity, and speedily establishing an equilibrium of condition in these respects between external influences and internal parts. The fever and nervous irritability which exist when perspiration is suppressed, illustrates the opposite effect of a dry skin, which is a bad conductor of electricity, as well as of caloric. In the skin, in fact, nature has provided a kind of compensating apparatus to meet meteorological irregularities, by increasing or diminishing perspiration. Thus, heated by unusual exercise, or a summer's sun, the fluid secretion on the surface of the body rapidly evaporating, gratefully cools or revives exhausted powers; whilst, under opposite circumstances, cold, contracting the pores of the skin, retards the circulation, and confines the products of chemical combustion, always going on in the blood, to the better sustenance of the natural temperature of the body. In an extreme condition, this latter process is well observed in the instance of hibernating animals, where life is maintained for several months, after all action of the lungs has ceased; cutaneous respiration alone being sufficient to sustain those changes in the blood, upon which depend the evolution of natural heat.*

* In a torpid state, nutrition may be said to consist chiefly of a proper supply of natural heat, and this is secured by the animal becoming enormously fat before seeking its winter retreats. Now it must be observed that fat is the most concentrated form of nourishment, containing eighty per cent. of carbon, upon which the heat-producing value of food depends, whilst the best wheaten flour, sugar, and arrowroot, contain no more than from forty to forty-four per cent.; and yet fat serves no specific purpose in the economy of life, other than as a special provision for the support of the frame, when the ordinary supply of food is interrupted by privation or the loss of appetite. Its manner of accumulating in the system is also very striking, as it forms no part of any organic structure, but

I have not placed the perspiratory system next in importance to the respiratory, without sufficient grounds for the distinction. The apparatus consists of a number of very minute tubes, arising from small glandular bodies, situated in the lower portion of the *corium*, or true skin, passing through the sensitive skin, and terminating in pores on the surface of the scarf-skin. The number of these pores in a square inch, counted in the palm of the hand, is not less than 3,500, and as each pore is the external aperture of a tube one quarter of an inch long, it follows that the length of such tube in a square inch of skin is about seventy-three feet. Apply the calculation to the whole body, and the amount of drainage thus provided for is wonderful to contemplate. And if obstructed in its functions a serious derangement of the whole animal machine must and does necessarily ensue.*

In health perspiration is continually going on, being more or less sensible as the body is at rest or in motion, and accordingly as the atmosphere is more or less dry. Charged with its *maximum* of moisture, the air cannot take up more, and the perspiration then becomes condensed in a visible form upon the skin, or else the operation will be partially to suspend the excretion, which is always accompanied with great discomfort and disturbance in the general health. Experiments prove that, whilst in dry air the body can sustain a temperature of 176 deg. F., for

is deposited between the various textures in little cells, like, as has been well observed, honey in its comb, for future purposes of nutrition. Like the oil in a lamp, or coals in the grate (almost all carbon) fat is a prepared fuel for the support of life, under circumstances such as we are alluding to. When called upon to enter the system, the *absorbents*, stimulated to increased activity, convey the fat into the general circulation, where it is brought into contact with oxygen derived from the air, and entering into rapid combustion with it, produces water and carbonic acid, accompanied with the phenomena of heat and electricity, as is observed in ordinary combustion. Spallanzani found that torpid animals carbonated the air in which they were confined, and he satisfied himself that this chemical change was affected through the medium of the skin, as respiration by the lungs was entirely suspended in the experimental cases that came under his observation.

* Taking a lower average, say 2,800 of these tubes, and calculating the number of square inches in a man of ordinary height and bulk to be 2,500, Erasmus Wilson says that the number of pores amount to 7,000,000, and the extent of perspiratory tube 1,750,000 inches, equal to 48,600 yards, or nearly twenty-eight miles.

a considerable time, without inconvenience, in air filled with a dense vapour a man can with difficulty sustain respiration for a few seconds only. The breathing becomes short and rapid, the pulse rises to 120, a profuse perspiration bathes the skin, sensations of suffocation become unsupportable, and death is inevitable in a very short time.*

It has been estimated that eight grains of perspiration are exhaled from the skin in the course of a minute, a quantity equal to three pints in twenty-four hours. The great proportion of this is water, about one per cent. only being solid substance, and of which, according to continental physiologists, in one hundred parts twenty-three are salts, the residue being organic matter. It would surprise my readers to learn how many and various are the substances the blood is relieved of, and so far purified, by the action of the skin. In a note below I give a detail derived from authorities that cannot be doubted, and which will give some idea of the disorder which must arise in the system, if through cold, or some affection of the skin, these extraneous matters fail in being removed by perspiration.†

* Sir Charles Blagden supported a temperature of 260 deg. for ten minutes, and the oven used by Chabert, the Fire-king, during his exhibitions in London, was heated to between 400 and 500 deg. F. The reduction of the heat of the body under such circumstances takes place at the expense of the water of the blood, and of the body generally. To be raised into vapour, water requires a large amount of heat, and in this way the excess is employed in dissipating it by perspiration.

“The ordinary temperature of the body, as ascertained by placing the bulb of a thermometer under the tongue, is 100 degrees of Fahrenheit. This may be regarded as the standard temperature of the human body in health, and it offers very little variation, in summer or in winter, at the equator or the pole. In disease, even, the variation is less considerable than might be imagined, the lowest temperature on record, namely, that of Asiatic cholera, being 77 deg., and the highest 110 $\frac{1}{2}$ deg. The sources of animal temperature are, the chemical processes constantly taking place in the body during the action of the various phenomena concerned in nutrition, and these, by developing heat, maintain a condition which is necessary to the continuance of life.”—*Wilson on the Skin.*

† Erasmus Wilson thus enumerates them:—“ Among the animal matter occurs a small quantity of fat. The gases are the carbonic acid, which is most abundant after a meal of vegetable food, and nitrogen, which is largely given off after animal diet. The acids

The vitalization of the blood in the lungs, its circulation through the heart and body, and its purification by the skin having been considered, I shall now direct attention to those organs and their functions, connected with the supply of the solid and fluid constituents, which enter into that living stream of rudimental material, for the nourishment and structural support of every part of the human frame.

I have described the body as being divided by the midriff, or *diaphragm*, into two cavities; one above—the chest, and its contents the heart and lungs, has been reviewed; the other, below—the abdomen and the several viscera contained, forms our present subject. The finger placed upon the centre of the trunk, just below the breast-bone, may be said, near enough for our purpose, to rest upon the *stomach*—a membranous, muscular bag, capable of holding three pints or more in the adult subject. As it lies in the body, its shape approaches the semilunar, being bent upon itself, the two extremities approaching each other; one towards the left, is called the *cardiac*, from its contiguity to the heart, and is the opening for the admission of food and drink, communicating by the *swallow*, or *esophagus*, with the throat and mouth; the other, on the right, is continuous with the intestinal tube, from which it is separated by a contraction, called the *pylorus*, and hence termed the *pyloric* extremity of the stomach. Its position

are butyric, lactic, acetic, hydrochloric, phosphoric and sulphuric. The alkalies—soda, potash, and ammonia. The calcareous earth—lime, in combination with phosphoric acid. The metals—per-oxide of iron, and, in persons engaged in such manufactures, lead and copper in minute quantities. And of general salts—a long list formed by the combination of the acids named with the alkalies and lime; the principal are the chloride of sodium (common salt) carbonate, phosphate, and sulphate of soda, chloride of potassium, and acetate of potash, lactate, and hydrochlorate of ammonia, and phosphate, and carbonate of lime. The remarkable odour of the perspiration is due to the peculiar organic constituent, *osmazome* (which also gives the flavour to meat) and to the butyric and lactic acids."

Of the effect produced by totally suppressing perspiration, and confining all these substances to the blood, some French *savans*, to satisfy themselves, covered a rabbit with an impermeable varnish. The result was, that the temperature of the body rapidly fell, and in one hour and a-half the animal died of asphyxia, the appearances being similar to those produced by suffocation, or where de-carbonization of the blood has been effectually prevented.

is across the body, the longer curvature connecting the two extremities, being nearly under the finger placed on the centre of the trunk ; the shorter, more inward and backward, has a general direction towards the under surface of the midriff, and its insertion in the spine.

The bag of the stomach, like the whole of the alimentary canal, in fact, is made up of three coats or coverings. The first, the most internal, is an absorbing and secreting one ; it comes in contact with the food, and is the principal agent in the process of digestion, and from its being constantly moistened with a secretion from its surface, is called the *mucous* coat or covering. And here it may be observed that the external skin, and this lining of the whole alimentary canal, are considered to be continuons, for when a portion of the former is made to occupy an internal position, it becomes a secreting surface ; and when the latter becomes exposed to the air, it loses its moisture by evaporation, and assumes the character of skin. It is usual to illustrate this by referring to the eyelids, on the under surface of which the skin is a true mucous membrane. This continuity, also, and a law founded upon it, that disorder in any one part affects, more or less, the whole, gives importance to the examination of the tongue in sickness, for when looked at we see, to a certain extent, the state of the stomach as well. The second coat consists chiefly of *muscular* fibres, by the action of which the capacity of the stomach is diminished or expanded, and the *mucous* coat thus kept in constant contact with its contents, and as each successive portion of the food becomes digested, passes it through the pyloric extremity into the intestines, and so on through the entire length of the alimentary canal. The third and last coat is a mere covering derived from the *peritoneum*, a thin delicate membrane which first lines the whole of the walls of the abdomen, and then, doubling upon itself, includes in its folds all the viscera and convolutions of the intestines contained in that cavity. It embraces the entire stomach, which is yet external to it, the inner surfaces of the peritoneal *sac* gliding over each other, and everywhere continuous, after a double night-cap fashion, the outside of which comes only in contact with the head it envelopes. A free vapoury exhalation from the inside of this membrane (apt to become, in disease, of a serous or watery nature) lubricates the surfaces of the organs suspended in it, and facilitates

their free movement upon each other. A remarkable prolonged fold of the *peritoneum* intervenes between the muscular wall of the abdomen in front, and the intestines upon which, like an apron, it lies, and must be familiar to many of my readers who have opened dead animals, as the thin, semi-transparent membrane, containing more or less of fatty deposits, in little lumps, observed in this situation.

The *intestines* commence at the pyloric extremity of the stomach, possessing the three coats, mucous, muscular, and peritoneal, just described in connection with that organ. Their entire length is about thirty feet, the first three-fifths of which constitute the *small intestines*, terminating in a little pouch called the *cæcum*, and which separates them from the remaining portion, or the *large intestines*, including the *colon*, and its terminating straight portion, the *rectum*. The external orifice of the latter is the *anus* or fundament.

The first two hands, or twelve fingers breadth (whence its name), from the stomach, is called the *duodenum*, between which and the *cæcum*, or head of the colon, are the extended and numerous convolutions of the remaining small intestines, the *jejunum* and *illium*. In the duodenum the duct conveying bile from the liver enters, as also do the secretions of the *pancreas* (or sweet bread), much of the same nature as the saliva which flows into the mouth from the salivary glands, and serves the purpose of rendering the digested food more fluid, and better fitted for absorption by the *lacteals*, a set of vessels which are numerously distributed over the mucous coat of the small intestines, and take up the milk-like nutritive juice called chyle, the product of digestion, and convey it by one common duct (in which all the *lacteals* eventually unite) into the jugular vein, where it mingles with the general circulation.

One of the most important of the organs contained in the cavity of the abdomen is the *liver*. Just where the elbow of the right arm would rest upon the side, may be described as its situation in the body. From the kidneys behind, this, the largest of all the glands, extends upwards under the ribs, and across the pit of the stomach, towards the left side. It receives in one current the blood brought by the respective veins of the stomach, bowels, spleen, and pancreas, united in the portal vein, and directed to the liver for purposes of purification; being charged with

many unwholesome and objectionable particles derived from the aliment in the stomach and bowels. To prevent these contaminating the vital stream, they are separated from and eliminated in the liver before the blood again returns to the heart. An infinitude of small ducts collect into a yellow, bitter, alkaline fluid, called bile, the matters thus thrown out, and which is conveyed by a common trunk (formed by these several ducts coalescing) into the gall-bladder, and from there, as occasions of supply require, into the duodenum, a few inches below the pyloric, or lower opening of the stomach. This circumstance gives a peculiar character to the duodenum, which has led some physiologists to consider it to be a second stomach, where the process of digestion is completed.

Three specific secretions or juices unite in effecting the conversion of the suitable portions of the food taken into blood. These are the *gastric* and *pancreatic* juices, and the *bile*. The food and drink, mixed with saliva and air during mastication, are conveyed into the stomach by the *esophagus*, or swallow. Here it is submitted to the action of the gastric juice, an acidulous vital product (whence its antiseptic properties) of the mucous membrane of the stomach, any excess of fluid present being first removed by absorption into its veins. The remaining aliment is now repeatedly agitated by motion imparted by the muscular coat, and intimately blended with this acid secretion or gastric juice, until in part dissolved, in which state it is progressively extruded through the pylorus into the intestines. In the duodenum the digested matter is rendered more fluid by admixture with the pancreatic saliva, or juice, and the bile, which dribble together into the intestine by one common duct communicating with the liver and pancreas. These additions render the compound mass more fluid, and the nutritious particles more apt for imbibition by the *lacteals*, or the chyle-collecting vessels before mentioned as being thickly distributed over the mucous membrane, along the whole course of the small intestines, and which drink up, as it were, every portion of proper nutriment, and convey the supply of new material directly into the blood, through the jugular vein, where they terminate in one common trunk.

The acid contained in the *gastric juice* is the muriatic derived from the common culinary salt (muriate of soda) always found in the blood. The secreting vessels of the

mucous membrane of the stomach, acted upon by a nervous electric current furnished by the brain through the medium of the *pneumo-gastric* nerves, decompose the salt, one element of which, the muriatic acid, is poured forth with the secreted fluid into the stomach, as the gastric juice; the other, *soda*, being carried with the remaining constituents of the blood to the liver, where it is also separated, to constitute the alkaline base of the bile secreted by that organ. The whole operation is an instance of the admirable adaptation of means to end, so characteristic of animal economy, for by the decomposition of a neutral and harmless element of the blood into its two active constituents, we have produced an alkaline fluid, the bile, flowing into, and being mixed with, the acidulated digested aliment, which, thus neutralized, becomes again fitted for absorption and reception into the blood.*

Besides the *lacteals* taking up and conveying to the blood the nutritive products of digestion, there are innumerable little tubes with contrasting, and yet still perfectly analogous functions, which permeate every structure, and serve as so many drains or sewers, imbibing and carrying away the used up material, to be replaced by the nutritive particles supplied by the blood, and first conveyed into it by the *lacteals*, as I have just been showing. These are the *absorbent* vessels, and appear to be subsidiary to the veins, which they accompany everywhere, and in which they all terminate. Physiologists have also proved this connection, for when from repletion, or extreme fulness and distension, the veins cease to receive the absorbed

* I recommend to the attention of physiologists the following experiment detailed in a little volume entitled *Memorials, &c., of Andrew Crosse, the electrician.* It satisfies every requirement for the artificial production of the gastric juice and bile, providing that the chemical composition are the same, of the acid evolved at the positive, and of the green oleaginous fluid at the negative pole of the apparatus employed. "Two cylinders, one of sheet zinc, the other of sheet iron, were placed in two porous earthenware tubes, open at the top and closed at the bottom. The metallic cylinders were connected by a copper riband, the porous tubes, with the metals inserted in them, were filled with water, and then placed in two gallons of the very worst English brandy, which was thus kept electrified for three weeks. At the end of that time the spirit was drawn off greatly improved—indeed visibly purified, for the water in the positive porous tube had become intensely acid, and the negative tube filled with a green oleaginous fluid, thick and turbid."

matters, exudation immediately ensues; an instance of which may be observed in the serous discharge, or dropsy, that ensues upon congested or retarded circulation in any part of the body.

In this descriptive summary of the abdomen and its contents, I must not omit to mention the *spleen*, an organ, the purpose of which was long a question of doubt and uncertainty. It is a spongy distensible viscus, lying over on the left side of the stomach. It has no direct communication either with the intestines, or other organ, and has actually been dissected out of the bodies of animals, without their appearing to be much injured by the loss. It is now considered to be a provision employed to meet the very different circumstances as regards the proper supply of blood to the stomach, in its two opposite states of distension or emptiness. In the former, the purposes of digestion requiring, and indeed exerting, a greatly increased local circulation, this is maintained by calling upon the spleen for an additional supply of blood, and which, as the excitement occasioned by a full meal subsides, again receives the now no longer required stimulus; thus allowing the stomach to recover an easy equilibrium of condition, favourable to the renovation of its digestive powers, and affording due preparation for the next exertion. It also serves somewhat the same purpose, when it interposes between any sudden application of cold to the surface of the skin and the consequent rush of blood upon the internal organs; and which would be liable to produce engorgement of the heart, and rupture of the blood vessels in many delicate structures, were not the spleen thus to provide for its reception.

The last of the abdominal viscera I consider it necessary particularly to make mention of, are the *kidneys*, two in number, situated in the loins, behind the intestines, and close (one on either side) to the spine. An artery to each kidney conveys the blood intended to be acted upon, and as the bile is secreted in the liver, so the urine is separated by these organs from the blood, through, no doubt, the electric instrumentality of the nerves with which they are endowed. Within the centre of the kidney is a membranous cavity, into which several little groups of secreting vessels, arranged in a fan-like form, pour their products, and which passes down a tube or duct some inches long, into the *bladder*, where the urine is retained, until, ex-

cited by distension, or acted upon by the will of the individual, it expels its contents.

When speaking of the peritoneal coat of the intestines, I described it as also investing the several viscera of the abdomen, by processes thrown over them, commencing generally where the blood vessels and nerves enter into the structure of each organ, and constituting together a kind of root or ligament, by which it is suspended or kept in its proper situation. And exactly as we find it to be the case with the *peritoneum*, a similar serous membrane, called the *pericardium*, encloses the heart in a bag, and another, or rather two more, the *pleura*, severally invest the right and left lobes of the lungs. I may further observe, that in the latter situation the peculiar bi-fold character of this kind of membrane may be most conveniently observed, and as well in any animal, such as a pig, ox, goat, &c., as in the nobler subject, man. It is the pale, glistening tissue which, like a strong, thin skin, defines the outer surface of each crepitating, sponge-like lobe of the lungs, as high as the root-like bifurcation of the wind-pipe, from whence reflected, it then becomes as closely attached to the inner side of the chest, in the cavity of which the entire organ hangs thus freely suspended, and moves readily and easily, in every situation of the body, over the two opposing surfaces of the one continuous lining, so admirably contrived to effect this important purpose.

Now, for a very long time it was considered that a thin membranous covering of the brain, called the *arachnoid*, lying between the strong ligamentous lining of the skull, called the *dura mater*, and another, but much more delicate one, the *pia mater*, consisting chiefly of small blood-vessels, and following closely all the convolutions of the brain, was of the same character as the pleura, pericardium, &c., and hence was described by many anatomists as a true serous membrane. Within the last ten years, the researches of an eminent English physiologist, Mr. G. Rainey (and among whose pupils I have the honor of being numbered) has satisfactorily demonstrated that the *arachnoid* membrane consists of innumerable filaments thrown off by the branches of the great sympathetic nerve which accompany the two carotid arteries in their distribution to the brain. It is inferred, therefore, that this intricate and extensive network of nervous filaments forms one grand plexus, uniting after having followed the mi-

nutest ramifications of the carotids in the substance of the brain, and thus investing that organ, and the spinal marrow in connection with it, with a continuous expansion of that portion of the nervous system especially devoted to sustain involuntary arterial action during sleep, and under varying circumstances of situation and condition, besides interposing a provision of grace, between many trifling accidents that would otherwise suspend the circulation in the brain, and cause instant death.

By retaining the original idea of the *arachnoid* being a *serous* membrane, yet receiving as true the demonstration and the explanation of its purposes as given by Mr. Rainey, I obtained a very satisfactory solution of many difficult problems presented by the appearances of disease in Natal, and it is this which has chiefly induced me to make this lengthened digression upon some details of anatomical structure that may be thought tedious and unimportant. Besides, warranted by what I have observed, I go even further, and include in the category of *serous* membranes the synovial linings of all the articulations or joints of the body, and believe that future microscopic examination of the little connecting channels, between the arteries and veins, called the *capillary* vessels, will demonstrate them to be minute nervous expansions of a similar character to the *arachnoid*, and claiming, like it, to be considered true *serous* membranes. And here it is, with the views I entertain, that *pathology*, or the study of disease, promises no small instalment of the great debt she owes to *physiology*, or the study of the causes of vital phenomena, as *anatomy* is of the structure of the human frame. The identity of symptomatic appearances in affections of different and distant parts of the body, may, I think, be made to illustrate, and even demonstrate, identity of structure and purpose in organs which have hitherto escaped the most ingenious endeavours to determine their real nature and character.

Material being or existence, to poor human sense, is wholly dependent upon organic life, otherwise, the vital functions of the frame. The visible connection between these (organs and functions) are certain string-like, white elongations, called nerves, arising either from the brain or spinal marrow, and which communicate with every part of the body by a somewhat similar infinitesimal subdivision of structure, as do the apparent interminable ramifications of

the arterial and venous systems. But the best illustration of this is the fact that, as the point of the finest needle cannot pierce the skin without drawing blood, so the same act is as necessarily accompanied with pain, demonstrating the equal universality of nervous distribution. A blush telegraphs an idea either of joy or shame, and the visible sensation is a mixture of mind and matter, due to this intimate association of nervous filaments with the blood capillaries, in one of the most delicate structures of the body.

But something more than the merely intimate association of blood vessels and nerves is involved in the flushing redness of the skin, accompanying some kinds of mental excitement. We cannot call it a secretion, yet in some respects it is allied to the flow of saliva into the mouth at the sight of tempting viands. Something unusual has affected the capillaries, that thus, on extraordinary occasions, brighten up with coloured blood. An opposite condition, too, is observed in the ashen-grey hue the face sometimes assumes when acted upon by anger or fear, and the difference is evidently that which exists between engorgement and collapse of these vessels. A very delicate electrometer might perhaps clear up the obscurity which surrounds the question as to the exciting cause of these contrasting appearances, and demonstrate the operation of two different conditions of nervous power analogous to the positive and negative electric states of inert matter.* At all events, to redden the face by a mental effort is an exertion as truly physical in effect, and the agency employed as mysterious, and not more material in its nature, than that which flashes gunpowder by a spark drawn from an electric eel.

The disproportionate supply of blood to the brain—being three-fold greater than that transmitted to any other organ—has a significance not to be overlooked, when it is considered that the amount of electricity or nervous power developed in a part, increases with the quantity and quality of the blood received. It immediately suggests the purpose of the latter is to convey those influences of vital

* Human hair is easily excited by electricity, and by a machine can be made to exhibit the same separated and stiffened condition ("like quills upon the *fretful porcupine*") which extreme fear is well known to produce in the hair of a living subject.

changes which, seen, or felt, or thought, are yet not bound by ordinary material laws; and whose operation, indeed, is to suspend, and even to subvert these, giving a positive and practical effect, not to be denied, to something immaterial, and beyond what the mind of man can measure or comprehend. All that can be safely assumed is, that the excited matter, contained in the coursing blood, is relieved in the brain of its electricity, to be employed in the human system as a *motor* power; stimulating muscular fibre through the medium of two sets of nerves, the *voluntary* and *involuntary*; in the latter directed by a supreme consciousness, to which mere reason is subordinate, selecting or casting out, in secretion and absorption, whatever the conservative interests of the frame require should be so knowingly dealt with. Thus we find the liver does not secrete urine, nor the skin bile, neither do the kidneys take out of the blood sent to them, ought but the particular particles it is their proper function to separate and remove.

It is generally admitted that this *electro-motor* power is accumulated in the brain as a centralized quantity, and a common stock to be distributed, according to the wants, or varying circumstances, of the several parts of the body. It is evident that, for any required effort of action,—say, for example, of the muscles,—that the supply of nervous power should be dominantly solicited by the will, sufficient for the exertion to be made. And, again, during the process of digestion, the stomach calls for, and in health obtains, an increase of functional power; as also does the *uterus*, or womb, at particular times, the latter being, perhaps, the best illustration that can be given of that law of animal economy, which allows any organ to monopolise, as it were, for a season, all the nervous or vital forces of the system, when necessary for the due performance of its functions, or which will enable it to overcome some abnormal, or temporarily opposing influence.* That this local concentration is at the expense of the whole, is clear, from the diminished energy of other parts of the body; and generally from the necessity of sleep, “tired nature’s sweet restorer,” to recruit the expenditure of the day. It is notorious that, after a

* In this manner, the greater susceptibility of the female constitution to nervous disorder, such as *hysteria*, sick head-ache, &c., is easily accounted for.

full meal, the head is duller, and the limbs more inactive, than previously to an indulgence in food; and conversely, in ill health, when the conservative instincts of the frame are intensely directed to establish restorative reaction, we find that the stomach gives up her periodical demand, and strikes the *toscin* of alarm in that general symptom of disease—loss of appetite.

Another law seems to be, that any extraordinary or excessive demand of *motor* power for local efforts, *beyond a certain amount*, diminishes the general energy of the whole body. Proper exercise (and in this consists its value) advantageously increases the reserve fund, and, as is evident in athletes, admits of a longer continuity of solicitation without fatigue; but it must be common knowledge that we cannot concentrate any one sense upon some assigned task, without taking from all the others something of their due to sustain this separate intensity. For example, we look with earnest attention, and we hear less readily, a touch even sometimes failing to arouse attention, and obtain a response. Again, the stomach requires power, but when grief or anxiety diverts nervous energy to painful thought, food is loathed; whilst, conversely, how often do we see that indulging thought in exciting, and sense in gratifying, the appetite, extinguishes mental activity, or, as Shakespeare has it:—

Fat paunches have lean pates; and dainty bits
Make rich the ribs, but bankrupt quite the wits.

The slow, unsteady walk of reflective habits similarly contrasts with the firm and active gait of the young and free from care; as does also the military seat of some thoughtless vagabond on horseback, compared with that of a contemplative philosopher like Dr. Syntax, or even of the plodding man of business, who rides like John Gilpin.

These illustrations are intended to insinuate how mechanical and how measured is the production in the brain of the *electro-motor* power, which, through the medium of the nerves, is conveyed to every part of the body, and acts as that conscious principle of assimilation which suspends chemical action among the constituents of the blood intended for nutrition, and determines organic structure; or, more directly under the influence of the will, governs and directs muscular action.

It is fitting, also, to remark here, that many irregularities

of action observed in the human frame, are to be referred, not to any positively disordered condition of the parts where such symptoms appear, but to sympathetic assistance afforded by one organ dispensing with its ordinary supply of nervous power, to contribute to an extraordinary effort made by another to throw off some burden, or cause of oppression. The first indications of disturbance in the liver are observed in the brain. Disturbed sleep, bad dreams, and sick headaches, tell of nervous sympathy aroused, and point to a remedy. An emetic, and the forced abstinence for a few hours in consequence, will, as a rule, effect a cure. The same economic purpose of natural relief obtained, by the co-operation of the whole system to one end, occurs in parturition. The eye becomes dull, the stomach rejects food, all motion seems sluggish and laboured, and the voice hoarse, from want of energy in the muscles of the throat to produce a sharp note, all indicating the concentrated action of the system upon the *uterus*, to assist in that great functional crisis, when the infant, ceasing to be part and portion of its mother, assumes, in birth, a separate and independent existence. This sympathetic co-operation constitutes, in fact, the *vis medicatrix naturæ*, the natural restorative effort to throw off, or overcome, any temporary disorder in the machinery of the frame; and where the susceptibility of the nervous system is best sustained by favourable climate, as is especially the case in Natal, these unfailing indications of approaching disease, like so many alarm posts by their early warning signals, contribute greatly to the maintenance of health, and to the wise and watchful promise length of days, and the fullest enjoyment of life.

Before concluding my remarks upon the functions of the brain, and nervous system generally, as the source, the reservoir, and distributing apparatus of that mysterious agency of the will, by which it develops itself, in material and sensible acts, I consider it a fitting opportunity to introduce (here only, however, as a general proposition) my particular views of the character of the climate of Natal, in its effects upon the human constitution. In this country, it appears to me, we approach more nearly to those conditions and circumstances of life, that, in a still more excellent state, would result in an almost total exemption from disease; death, of course, being considered, as it ought to be, a necessary concomitant of existence, like birth, a

mere phenomenon of vital progress, not, as is now too frequently the case, an unnatural termination, arising from an abnormal or accidental interruption in the machinery of life.

And in the first place, to assist me in my exposition, as certainly belonging to the subject, let me refer to the well known and generally acknowledged lightness with which the *curse* of difficult and painful parturition falls upon Eve's daughters in Natal. It is here reduced to its *minimum* intensity. The long protracted and dangerous times of European experience are unknown, as the general rule, and to the native born, whether among the white or black population, the interesting event comes on with comparatively cheerful indifference, and passes over with no more disturbance in the system, than might reasonably be expected to accompany a momentous but perfectly natural operation.* This is easily accounted for, if it can be supposed that excess of nervous susceptibility, instead of being developed in hysterical excitement, is directed in such cases to an useful end, and hence the benefits many female constitutions derive from the marriage state. The otherwise irregularity in the system thus becomes changed into a natural effort; surplus power has been economised, and made to produce that relaxation of irritable resistance to impressions, which seems, under some circumstances, to characterise muscular fibre (as in spasms, convulsions, &c.), when not properly or healthfully under strict subordination to vital influences, originating and proceeding from the brain, or its prolongation, the spinal marrow.

In the next place, it may be asserted of disease in Natal, that it is resolved into its simplest and safest character. As a rule, symptoms there are cures or checks upon disordered action. Neuralgic pains and sick head-aches are mere temporary inconveniences, sometimes richly deserved. Spontaneous diarrhoeas save many a doctor's bill, and even dysentery, in bad, neglected, or careless habits, by diverting suppurative inflammation from the liver, and affording time

* On ship board I have noticed a similar beneficent suspension of the pains and perils of child-birth, and attribute it to the same condition of the nervous system, being induced by a temporary residence upon the moving waters of the deep, as, in this particular, is evidently the effect of an African climate upon the female constitution.

for reflection, or benevolent suggestion, or personal reform, is the means of preserving many more lives than it destroys. The common remittent fever of the country (various as are its names—biliary, gastric, nervous, and typhoid) is the measure of social good government, and will disappear before advancing intelligence, and a well ordered sanitary police. Aggravated, it is the plague of Alexandria. Two centuries ago it decimated London. But who fears it now? Food of good quality, proper exercise, ample ventilation, and a succession of fasts and festivals in an almanac of health, promise to constitute a *materia medica* best suited for Natal.* On the contrary, in England, and the northern hemispheres generally, mortal diseases are as numerous as there are symptoms of disorder. Uncontrollable local reaction (acute inflammation, for example,) from perhaps the slightest exciting cause, in its morbid intensity, frequently destroys organic structure, and cuts short the life which normally (if it be not a misapplication of the term) it was intended to succour and preserve. The difference, indeed, between the circumstances of life in Natal and elsewhere, in a *pathological* view, that is, from a stand-point of disordered action, is that between a beneficent angel, troubling only to heal, and a many-headed Hydra, assaulting on every side the human frame, and converting, by its poisonous breath, every salutary effort of nature, into a distinct and well defined mortal disease.

The cause of this very remarkable constitutional difference in the human body, appears to consist in the circumstances of external nature—the soil, climate, and geographical position of Natal, being more favourable for the fuller development of an important function of the nervous system, than seems to be the case in any other country; at least, wherever recorded experience affords us the opportunity of judging. Like a tree in its native *habitat* exhibits a luxuriance and beauty only partially enjoyed under exotic conditions of season and place, so man's physical nature varies in vigour and appearance accordingly, as the sources and supply of the requirements

* Ladies certainly will not disapprove of my suggestions when, for their especial benefit, I add, that a horse and piano, luxuries everywhere else, are very necessaries of life here; as cheerfulness and content are unexceptionable prophylactics, and afford, by far, the best surety for the continuance of health.

of life are of a harsh or generous character. And as the one, by some natural effort of a sound constitution, is enabled to repel early, and cast off all parasitical plants and insects, which otherwise would sap its powers, and eventually destroy it; so the human frame, in happy situations, is endowed with analogous powers of a conservative kind, which protects it from unwholesome impressions being easily received; meeting, as it appears to me, first assaults, by a salutary alarm in the nervous system, and rousing a reactionary resistance equal, under ordinary circumstances, to the task of correcting or neutralising the approaching evil. For example, the slightest illness in Natal is generally attended with great depression of the spirits, and a fear of consequences, that at once incline the subject to a dose of medicine, or some simple course of discipline, by diet or otherwise. Oftentimes, indeed, the chief danger lies in an exaggerated idea of the complaint. Nor does this condition even await disorder, for the climate seems to operate specifically upon immigrant systems, so as to produce, after a very short residence, a striking change in feelings and constitution. Strong-minded men begin to question situations and circumstances, of which a thought of distrust never occurred before. Others become really hysterical, and those of extreme habits are certain, sooner or later, to fall victims to *delirium tremens*. Again, as regards women, even when strong and healthy, their usual nervous susceptibility, on particular occasions, is aggravated to downright irritable fever, simulating hectic, and which, under circumstances of long continued excitement and exhaustion, too readily assumes a puerperal and highly dangerous character. But still, however inconvenient for the time this sensitiveness of the nervous system may be, experience soon discovers the advantages it affords as regards general health, and the protection yielded to organic structure, for long before these can be seriously affected, the darkened shadow of threatened evil is sufficient to warn and deter all but the doomed insane, from improper courses of living or action.

A converse condition in England will yet further illustrate this part of my subject. It is matter of common observation there, that the most mortal diseases are attended, fortunately for the patient's happiness, with a sense of the greatest assurance of a favourable termination. And this extraordinary confidence, so strikingly displayed under circumstances of extreme danger, is also more or less charac-

teristic of the approach of illness generally in that country, for it is seldom until organic disease has set in, that any endeavour is made, or proper measures taken, to arrest its progress. How many fatal cases of consumption have to be attributed to colds neglected? Nor is it usual to pay serious attention to symptoms of indigestion until they threaten to become a permanent inconvenience. The exceptional cases to this absurd rule of confident life assurance, are the so called hipped, the nervous, or the melancholy, who are laughed at or pitied by their really fraailer contemporaries, although I believe they mark the future long-lived of the generation to which they belong; an opinion supported, at all events, by the proverb, "that a creaking gate hangs longest on its hinges," usually applied to such habits and temperaments, and which evidently alludes to a longevity observed to be the usual lot of these constitutional grumblers.*

In considering further the character, and probable causes, of this constitutional peculiarity in the inhabitants of Natal, I have been led, not only to infer that its operation is nervous, and its nature a proper function of the brain, but that its comparatively fuller development there is more apparent than real, arising from a natural sensitiveness of the system to external electric changes and conditions, which elsewhere seems to operate through some obscuring or obstructive medium. For example, if I say light is a great cerebral irritant, I assert only what, in particular cases of illness, is acknowledged and acted upon in England. Darkened rooms, however, as a remedial adjunct, will be found to be of far more general consequence in the treatment of disease in Natal. In the former country, light is considered chiefly as an aggravating influence, but here it frequently amounts to an exciting cause, and its morbid reaction upon a disordered brain, is not inaptly illustrated by the optical illusions so characteristic of *delirium tremens*, which, more or less, I

* This familiar illustration must not be taken as if I were trifling with my subject. To be properly understood by the general reader, for whose information I am writing, it is necessary sometimes to use an apparently *ad captandum* mode of reasoning or explanation, especially where I have so little space for lengthened argument, or laboured demonstration. Should, however, the positions I have assumed be challenged by any professional critic, I shall be "always ready" to answer objections, and give sufficient reasons for the views I entertain.

have never yet found absent in disease in Natal. Now, if it be presumed that greater intensity of light prevails in the southern hemisphere, than is the case in the northern, whether owing to different quantities of moisture in the atmosphere, or any other cause, we explain, to some extent, the greatly increased sensitiveness of the nervous system we are alluding to, and which is thus trained or strained, according to constitutional strength, to meet the circumstances of situation.

The susceptibility thus actively developed is, I believe, a normal function of the brain, following up that instinctive consciousness of what will be required, which produced the features and the limbs of the foetus in the womb. Nature, in after life, being her own medical adviser, is not one whit less wonderful or merciful, and in Natal, at all events, I see indications of a habit of body which, natural or acquired, in its results approaches this generally admitted *desideratum* to complete the excellence of God's last and greatest work. These views, singularly enough, accord exactly with a recorded condition of human life, contained in an authority, the weight of which few will dispute or deny. The longevity of the antediluvian patriarchs, appears to me much more natural than the contracted span which now measures probable existence. Long protracted ages of a downward tendency in man, both physically and mentally, have reduced to a term of seventy years the average standard of human life, and even this, representing the experience of a time coeval with the building of the first temple of Jerusalem, far exceeds what modern observation proves to be the fact. But a long night seems breaking before the sun of Christian regeneration. Enlightened knowledge is a dawn of great promise, and, above all, the study of health, and how to preserve it, seems most calculated, by addressing itself to every man's best interest, to disperse quickly the remaining mists and clouds of ignorance or prejudice. Recent writers upon the economy of the human frame, seem all inspired by an increased idea of the importance of their subject, and not a few express sentiments, indicative of a conscious want of some great generalizing mind—some Newton in pathology and physiology—that will reduce into a grand and harmonious system, the many new and startling facts scattered through the innumerable discoveries in those sciences, made during the last fifty years. But to com-

plete observation, and indeed to suggest the scheme of some such "Cosmos" of animated nature, a residence in Natal, or some similarly fortunate locality, will be imperative. Comparing small things with great, how often has its peculiar topography, and the interesting solution of many obscure questions which have occurred to my own mind, conjured up a picture of that cleft in the rock wherein Moses shrouded himself from the awful majesty of the glories of God, that passed before his favoured eyes. Here, at all events, the zealous student, and earnest friend of his race, must come to complete his education; and although I, perhaps, may never share in the extensive satisfaction of truth these will certainly enjoy at no distant date, I still feel surely the bright promise and certain hope that, angel-like, always seem to herald the advent of some great boon to mankind.

To return, however, to the *vis medicatrix naturæ*, with me no obscure surmise, to explain spontaneous reaction, where otherwise the progress of disease is to excite—exaggerate—exhaust; but a definitely described function of the brain, which, by controlling nervous power, on the earliest approach of evil, alarms—arrests—restores, and thus links bodily health immediately to a conservative instinct of vitality, exactly as instanced in the gravid womb, where the continuation of the species requires that an intuitive consciousness shall be as intimately allied with the growing requirements of the human frame. The sphere of its divine operation includes also the direction and control of the other electric agencies, besides light, which produce or constitute vital phenomena, or all of being that is not mere physical organism. And chief of these, as I have before attempted to show, is the evolution of *caloric*, during the several processes of nutrition. This importance is well measured by the disturbing effects, as regards health, which arise from any irregularity in the supply of natural heat; and as it clearly appears the grand balance of functional power and healthy organisation lies in proper diet, we evidently possess, through its medium, ample and direct means of control over all those subtle influences of external nature, which tell with such prostrating, or, on the other hand, exciting effect, upon the strength and comfort of the body. It therefore needs no apology for introducing here, another necessary digression upon the physiological and chemical results of the several kinds of aliment, which

man ordinarily uses to sustain and continue his material frame.*

The various articles of food consumed by man have been of late years very carefully examined, both by chemists and physiologists. The former have determined the ultimate constituents of the several products of the vegetable and animal kingdoms used in ordinary diet, and also of what the different tissues and secretions of the body are composed. The relation of one to the other in the order of demand and supply is direct and suggestive, and the public mind for the last fifty years has been so admirably tutored by the advance of agricultural knowledge, and the well-proved necessity of consulting the elementary wants of the soil in the choice of manures, that it is not surprising a somewhat analogous method of calculating how the human frame may be best nourished and supported, by the careful adjustment of particular kinds of food to the circumstances and wants of the individual, has become almost as extensively popular. With this view food has been rather arbitrarily classified,—firstly, into the strictly *nutritive*, or aliments rich in nitrogen, alone capable of forming organized tissue, and which are vegetable albumen, fibrine, and casseine, and animal flesh and blood; secondly, into the *respiratory*, or heat-making, which includes substances containing no nitrogen, therefore inconvertible into tissue, and chiefly serving the purposes of respiration in the production of animal heat. These are animal fat, oils, starch, gum, sugar, pectine, wines, beer, and spirits. The inorganic substances contained in the blood, water, salts, iron, &c., constitute a third class; but for all general purposes it is usual to describe food simply as being either

* From the army and navy dietary scales, both of France and England, based upon known quantities consumed by large bodies of men in active life, it is inferred that $2\frac{1}{4}$ lbs avoirdupoise of dry food per day are required for each individual. Of this about three-fourths are vegetable, and the rest animal. Yearly, the amount is about eight hundred pounds per man. Of the various kinds of drink used, the estimated quantity is fifteen hundred pounds. From the air, it is calculated, in the same time, eight hundred more pounds of solid material is derived. The aggregate which each man thus receives, amounts to three thousand pounds a-year,—say a ton and a-half, or twenty times his weight. This enormous quantity of food sufficiently shows the structural requirements of the body, and the circle of changes continually going on, to sustain the material integrity of the human frame.

nitrogenous, or tissue-making, and *non-nitrogenous*, or heat-making.

This fundamental classification, based upon actual experiments, abundantly productive of light upon the important subject of nutrition, has, however, as usual with any great and sudden advance in human knowledge, been extended far beyond its proper legitimate application, and become almost empiric in the specious attempts made to solve by its assistance any, and all, of the numerous physiological problems exhibited in life; and by the boldness which advances mere chemical science as holding the key to those mysterious processes in animal economy, termed vital, in contra-distinction to the ordinary physical phenomena observed in external nature. But, to be told of *what* ultimate elements any article of food is composed, and what are the material requirements of the human frame, is not informing us as to *how* these elements are combined to effect the purpose, nor how selected or assimilated for the desired end. The usual way of illustrating this is by reference to the microscopic ovum of any animal. Here, within a sphere, invisible except by the aid of a powerful instrument, is found every necessary element for the production of a perfectly organised animal structure; so arranged and influenced, however, that all chemical action is suspended, as the chief condition of its preservation; for, should this operate, decomposition, and not vital development, immediately ensues. Under such circumstances we must presume controlling power somewhere, of which, or where it resides, man as yet possesses only the bare idea. Even admitting that the production of natural heat in the body is a purely chemical operation, and the deposition of the material in forming tissue a mere mechanical one, still the selection and direction of particular substances to proper parts is an effort or exercise of conscious power we can refer to none other but a supreme supernatural cause. The common vulgar, of course, are in the habit of superstitiously considering this to be "the divinity that hedges us in;" plainly unphilosophical as such a refuge is from the amazing and perplexing obscurity that surrounds the contemplation of the subject, and from which, as out of a cloud, seems to issue a still, small voice, that to human reason says—"Thus far shalt thou go, and no further; and here must thy proud thoughts be stayed."

In cautioning my readers, however, against relying too

much upon the strictly chemical character of nutrition, I would, on the other hand, remind them that they expose themselves to the opposite error, of overlooking one of the best means of acquiring accurate knowledge regarding it, if carried away by the reactionary representations of recent physiological commentators and critics, they are led to reject the really valuable aid of chemistry, in elucidating the best forms of food to be taken under different circumstances of situation ; and besides, that science also offers a wide field of research, where many new and interesting facts may be acquired, connected with the conservation and repair of the frame, when wasted or debilitated by disease. Although, therefore, Liebeg's celebrated two-fold classification of food into *nitrogenous*, and *non-nitrogenous*, has been found not to satisfy the rigid exactness of scientific inquiry ; and as his *dicium*, "that only those substances are in a strict sense nutritious, which either contain albumen, or a substance capable of being converted into albumen," appears absurd to physiologists (who, of course, consider nutriment, in its proper sense, to be that which supplies the structural requirements of every particular part of the body, such, for example, as the phosphate of lime to constitute bone, the salts and iron of the blood, and in short every essential constituent of *tissue* of any kind, the presence of which is as imperative as the albumen they contain,) still it will be useful to adhere in part to the explanations his chemical theory affords of the many changes food undergoes in the system, before it can be converted into blood, flesh, or finally, exhausted of all nutritive value, thrown out of the body in the usual excretory form.

The phenomena attendant upon the development of animal heat may, at all events, be safely referred to chemical action continually going on, sustained by the reaction of respiration upon the blood, materially altered in character and constitution during its circulation through the frame. One leading principle of a natural classification of food has been accordingly deduced from this, which is, that it must possess some *heat-producing* constituents, and, as was observed a few pages back, the amount of carbon contained affords the best standard of the relative value of different articles of diet, as regards sustaining the temperature of the body. The operation is generally admitted to be one of mere combustion, as direct, and as easily

demonstrable, as the burning of coal in a grate, or of oil in a lamp. But, as it seems, this specific function of the carbon does not commence until after it has subserved the equally important purpose of forming the principal solid constituent of all the soft parts of the body. The economy displayed in this arrangement strongly recalls Pope's expressive lines:—

In human works, though laboured on with pain,
A thousand movements scarce one purpose gain ;
In God's, one single can its end produce,
Yet serves to second, too, some other use.

Into the human system, carbon is introduced with every article of food used, and goes directly in the products of digestion to the building up and repair of the frame. Muscle or flesh (the weight of water deducted) contains fifty-four per cent., and fat, no less than eighty per cent. of carbon, and which, having served its purposes of deposit, as part of the body, after a term of vital exercise in the excitement of life, is displaced by new increments, seized upon by the *absorbents* as used up material, and carried away by the veins to the lungs, where these old and worn out particles, burnt in the frame, become changed again, forming, with the oxygen of the breathed air, carbonic acid gas, which, truly the smoke of this spontaneous combustion, escapes in the act of expiration, up the chimney of the throat.*

But though the carbon of the frame is thus excreted from the blood in the lungs, and the operation is evidently

* It occurs to me, that carbon, as nutriment, enters the general circulation in one electric condition (negative or positive, to be determined by future experiment), and that, when brought to the lungs to be discharged, it is in an opposite state to the oxygen of the air; the action and reaction of these two antagonizing elements, —constantly sustained by nutrition, on the one hand, and by respiration, on the other,—thus constituting the spring and source of mere organic life. The nearest mechanical approach to this which man has obtained, is in an electric toy, familiar, I dare say, to many of my readers. In a little box is concealed a voltaic pile of zinc and copper plates. Upon this stands a revolving horizontal cross, the excited arms of which are alternately attracted and repelled by opposite electric poles fixed in the angle of the box. Thus is kept up a constant motion, without any apparent cause, and which will continue whilst the materials remain free to act, from the opposite electric impulses contained by the concealed pile of metals, reacting, through the discharging poles, upon the revolving arms of the cross.

attended with a chemical change in condition, it is not in this situation that natural heat is developed for economical distribution through the frame. This is effected by the real combustion of textural organization taking place in the capillaries of the skin, and various secreting organs of the animal system, and where, as in the corresponding capillary link between arteries and veins, in the shorter circuit of the blood through the lungs, both heat and electricity are generated and given forth, being sensibly felt in a genial warmth, or, on the contrary, evinced by the irregular heats and chills of disordered health. This is also seen, to some extent, in the change of colour, from the bright red of arterial, to the purple hue of venous blood, which takes place during its momentary passage through the capillary vessels.

Another purpose that I have in view, in directing my reader's attention to the classification of food on chemical principles, is to impress the necessity of always considering the character of what they eat, and the circumstances of season which surround them at the time. It is of more importance than may at first cursorily appear. Popular instinct, however, based upon a natural truth, directs us all, in summer, to prefer, as the chief articles of diet, salads and fruits; and, on the contrary, in winter to select the fattest meats. Horticultural shows in the hot months, and prize cattle for Christmas entertainments, also practically demonstrate the physiological wants of our frames during these respective seasons. And the simple solution is, that in winter we require, as a protection against the cold, food containing a large amount of carbon, and find it in fat meats and rich pastry; whilst in the summer the reverse is the order of nature, and a vegetable diet (which, on an average, does not contain twelve per cent. of carbon) best suits us for the little increase of animal heat the purposes of life demand during the hot months of the year.

As regards many other economical wants of the system, the value of chemical knowledge in this respect, and of the constitution of different kinds of food, is apparent, under several circumstances of disordered action, or structural requirement in the body. Thus it would be easy to starve an infant to death, or at least kill it artistically by a convulsion fit, if we designedly weaned it, and confined it to a constant diet of arrowroot, which containing no *bone-earth* (phosphate of lime) would deprive

the little thing of a first great want of its frame, and, preventing the proper development of teeth, would fatally expose it to intense *cerebral* or brain excitement, which more or less (accordingly, as I believe, to accidental causes connected with its food) always accompanies dentition. In old age, again, the choice of food should be determined very considerably upon chemical grounds. For example, the use of arrowroot would now seem to be indicated, inasmuch as that ossification of the arteries, and the general tendency to earthy deposits in many of the tissues, so characteristic of declining years, would thus be met and obviated.

With respect to the *tissue-making* constituent of the blood, and which describes an element entering into every form of organic structure, whether brain, or muscle, or bone, it is agreed that *nitrogen* has the first claim to be considered this general characterizing material of living organisms. I have before remarked upon the obscurity that surrounds the probable source of the supply of *nitrogen* necessary for the purpose of building up the frame. It is impossible to deny that some is taken into the system from the food, when we see that, under circumstances of great bodily waste, a flesh diet, rich in nitrogen, is absolutely required; or this would contradict the experience of every convalescent to whom mutton chops, or veal broth, have been enjoined by his medical attendant. When we consider, on the other hand, that three-fourths of the air which we breathe consists of *nitrogen*, and that we live, as it were, in a mixed ocean of this gas and oxygen, it is no extravagant inference, that some as yet undiscovered, but most important relation exists, between the functions of the skin, and a provision for the nutritive purposes of the body; by its exerting a vital influence upon this, the largest constituent of the atmosphere, and converting it directly into the characteristic material element of all organic structures. And herein, perhaps, will lie the solution of all questions relative to the influence of fresh air and exercise upon debilitated frames, account for the fatty engorgement of pampered ease and sloth, and explain how it is that the fullest muscular development is obtained by active exertion or laborious employ.

The two grand elementary principles of nutritive value—the *heat-producing*, or carbon, and the *tissue-making*, or *nitrogen*—must not be pushed so far as to deny an equal

importance to every other constituent of the blood, however trifling in quantity, which supplies some specific requirement of particular parts of the body. As a recent writer observes:—"Blood is not blood without its salts and iron; bone is not bone without its phosphates; muscle is not muscle without its salts." Were it otherwise true, the matter of aliment would be easily settled by restricting diet to concentrated preparations of carbon and nitrogen, thus treating the animal frame as agriculturists do the earth, and applying directly the great structural wants of the system. But to prove how insufficient to support life for any length of time is any particular kind of food alone, hundreds of experiments have been made, sometimes, in my opinion, far more curious than instructive. Dogs fed on rich gelatine soup soon perish from starvation, and still quicker when supplied only with bread. Pigeons deprived of all sources of phosphate of lime, die, in a short time, of diarrhœa, and a general softening of the bones; whilst it is popular belief (for the truth of which, however, I do not vouch), that criminals in Holland were formerly exposed to a lingering, but certain death, by supplying them with bread from which salt was carefully excluded.

On the other hand, some concentrated forms of nutriment are available to man, under the direction of experienced nurses, and careful medical advisers, to serve extraordinary calls for renovation, or to meet undue waste of particular tissues in some disordered actions of the frame. In fractures of the bones, for example, eggs, and a milk diet, which contain a large proportion of bone earth, can be very properly enjoined, and, for an opposite reason, arrowroot messes forbidden. Alcohol, again, under some circumstances, is the very best kind of aliment. In low and prostrate conditions of the nervous system, when ordinary food is loathed and rejected, a stimulant diet of brandy, sugar, and water, seems to yield, in a convenient and direct form, that *heat-producing* essential in the blood which otherwise, for want of a proper supply from ordinary sources, is obtained at the expense of the frame—a result familiar to the most careless observer in the emaciation attendant upon disease; the consuming fire always sustained in the circulation requiring the necessary fuel, first takes it from the fat, and afterwards by the actual disintegration of some of the tissues, unless met by a diet

which, yielding the required elements, limits, of course, the combustion of the constituents of the body.

But *nutrition*, or the assimilation of new material in the place and for the purposes of old, is only the one half part of structural economy. Another important operation is to effect the exchange, and remove out of the system, the exhausted and used up particles thus displaced. The general term for this is *secretion*; at all events I limit my meaning to the functional processes of the several glands of the body, which seem appointed to select and cast out of the blood some obnoxious element which would otherwise vitiate and deteriorate it. The greater amount of muscular tissue, I have shown, escapes by respiration, in the form of carbonic acid gas. The perspiration disposes, in a great measure, of the waste water, and many of the saline debris of the system, whilst the exhausted *nitrogen* escapes in the urine eliminated by the kidneys from the blood.* In further explanation of this economic process, I must also observe, that a notable difference exists between the character of the blood flowing in the arteries, and of that which forms the venous current. In the former is conveyed a pure uncontaminated stream, the same everywhere, in the largest as in the smallest vessels; but, on the contrary, in the veins there is, as it were, a confluence of many draining canals returning towards the heart, each bringing, from the several organs, and other parts of the body, a contribution of something foreign to

* A notable illustration of the active agency nature employs in guarding carefully the purity of this vital stream, is seen in the local excitement and little swellings which immediately set up in the groins or armpits, or under the jaws, upon the accidental or artificial introduction of any abnormal secretion, such as diseased matter, into the skin of any exposed part. Seized upon by the absorbents, the offending particles are carried to the veins, but before being received into the general circulation, are obliged to submit to a searching examination in the glands, and whatever is obnoxious to the vital integrity of the blood, positively refused further progress, and is either altered in constitution by chemical changes which will adapt it to the purposes of life; or else, in weak and debilitated constitutions, where this instinctive medical effort of nature for relief is gone, what is called *suppuration* ensues, local *gangrene*, or death of the immediately surrounding parts take place, which, forming an abscess, ultimately, in the form of matter, is dissolved, and washed away with the first offending cause, and, in fortunate cases, ends in a renovation of the parts, and a return to a healthy state.

the blood, and of the nature of their seats of origin. The used-up particles of the various tissues are conveyed away in the veins, and, as a consequence, the blood returning from the intestines, from the liver, or from the muscles, is severally affected by the specific character of the detritus it is thus conveying out of the system.

It has also been recently proved, by both French and English physiologists, that besides the organs of especial secretion, every single part of the body, in relation to all the others in the general process of nutrition, possesses proper secreting functions, removing, in the very act of development, something that would otherwise be injurious to the whole. Thus the formation of bone separates the lime from the blood, and the constant growth of the hair also removes its constituent elements from the same vital stream. It follows, that from this general source of nutrition, every natural process takes its appropriate requirements, which would otherwise be in excess and burdensome; so far, of course, contributing to a condition most favourable for the healthy continuance of the whole system of man's physical economy. The change in the voice, the growth of the beard, &c., as puberty approaches, are striking evidences of the effects produced in the general state of the constitution at a critical period, when new functions are superadded to organisms, which alter the previous relation of the constituents of the blood supply, and the requirements of their new condition. This is explained by the fact, that when two functions are connected in nutrition, without that connection being manifest except in altered appearances, it arises from each secreted novelty being the product of materials left in the blood on the formation of the other. From this cause birds, in the pairing time, acquire their most brilliant plumage, and stags, in the same season, renew their antlers. It may be as well, also, to notice here, that any interruption in this structural process of secretion, is always marked by considerable disturbance in the general health, sufficiently well instanced in the female constitution, when what is termed the "change of life" occurs, and which marks the close of that natural term of years, within which the reproductive powers of the body are confined. Tuberculous consumption, which develops itself most actively about the period of puberty, may also be referred to some critical change in the constitution of the blood, owing to new

functions being assumed by mature organisms. Late experiments prove the small granular bodies that form in the lungs, and mark the first stage of consumption, consist chiefly of *albumen*, and, it is supposed, as the *serum*, or fluid portion of the blood, is an alkaline solution of albumen, that some acid secretion, determined by the changes of circumstances alluded to, may, by neutralizing the alkali in the *serum* (which alone circulates in the delicate membranes of the lungs), lead to the deposition of albumen, and thus form tubercles. Lactic acid, which abounds in milk, and at the age of puberty naturally increases as a secretion, is probably the cause of the deposit as described ; especially as we know that the skin naturally gets rid, in perspiration, of any excess of acid, but which, in delicate constitutions, may throw part of the newly acquired burden upon the lungs, associated in functions as the two organs are. Pregnancy, when the constituents of the lactic acid may be presumed to be required for the support of the foetus, puts a stop to all symptoms of consumption, and so far this view is corroborated.

To sum up in a few words the whole process of nutrition, we see,—firstly, that any excess of fluid taken into the stomach with the food, passes almost directly into the blood-vessels distributed over that organ. The juicy products of digestion, as these separate from the general contents of the stomach and small intestines, are also absorbed or sucked into the *lacteals*, a system of innumerable little vessels, the mouths of which open upon the inner surface of the mucous folds and numerous convolutions of the small intestines. These *lacteals* ultimately combine to form one trunk, which terminates in the jugular vein, and in this manner the new supply is conveyed into the general circulation. It is now exposed to other agencies in respiration, which fit it, in the form of arterial blood, for all the higher purposes of nutrition. To every part of the body is the revivifying fluid sent, to supply the momentary requirements of every vital operation. Not a muscle is put into operation without producing a change of condition in its constituent fibres. In every organ of involuntary action, an operation, of the nature I believe, of successive electric discharges, conducted through the medium of the nerves from the great centre of intelligence, is continually altering the relations of a negative and positive state between the ultimate particles of mus-

cular tissue—between the old about to be removed, and the new constituent provided to replace it. Thus we approach towards some idea of naked vitality, and obtain a glimpse, however imperfectly, of the nature of that mysterious agency which sustains and supports the material fabric of existence. The exhausted particles of the frame, exchanged for the arterial supply, naturally fall into the current of the blood now conveyed in the veins, or into excretory vessels especially provided and organized for the purpose of separating the used-up *debris* of the frame, and which is ultimately thrown out altogether in the form of the ordinary excretions. A recent writer in *Blackwood's Magazine* (June, 1858), treating popularly of the nature and constitution of the blood, makes use of an apt illustration, to convey somewhat of his meaning, on a necessarily obscure subject to most of his readers; and as my object is the same, to bring a knowledge of important, but generally little considered subjects, to the minds of the many, I have no hesitation, in concluding my remarks upon the subject of this chapter,—the *support* of human life,—to quote him here:—"The body is like a city intersected by a vast network of canals, such as Venice or Amsterdam; these canals are laden with barges, which carry to each house the meat, vegetables, and groceries needed for daily use; and while the food is thus presented at each door, the canal receives all the sewerage of the house. One house will take one kind of meat, and another house another kind, whilst a third will let the meat pass, and take only the vegetables. But as the original stock of food was limited, it is obvious that the demands of each house necessarily affect the supplies of the others. This is what occurs in nutrition. The muscles demand one set of principles, the nerves a second, the bones a third, and each will draw from the blood those which it needs, allowing the others, for which it has no need, to pass on."

CHAPTER IV.

The *physical economy* of the body:—Vital instinct—discriminating power in stomach. Connection with brain—the *par vagum*—a proper nerve of sense. With rest of the body—the great sympathetic nerve. Physical health—undisturbed integrity of functions—disease—ignorance or error in diet—natural sources of alarm—symptoms—part of cure—aggravations. Nervous irritation—pain—exhaustion—paralysis—sick headache—anxiety. Fevers—bilious, gastric, rheumatic, puerperal,—typhus. Effusion upon brain—ulceration of mouth—stomach—bowels—dysentery—enlarged prostrate—relaxation of uvula of pelvic viscera—abcess in internal organs—incellular tissue—absence of active inflammations—of consumption—of scrofula—leprosy. Concluding remarks.

Human life, as influenced or affected by residence in Natal, is the last division of my subject, and includes the consideration of those disturbances and variations in the ordinary phenomena of man's *physical economy*, which may fairly be attributed to local causes; or, as is the case frequently with first settlers, which arise from the incongruity of constitutional habits formed in one country, suddenly exposed in another to new circumstances of soil, climate, and situation.

The peculiar hair of the negro, the thick parieties of his skull, the colour and texture of his skin, all indicate a wonderful conscious principle, directing inert matter to assume structural peculiarities so well suited to his *habitat*, Central Africa. His curled crisp hair, a bad conductor, is a provision against heat, as markedly designed as is the metallic rod attached to a house to protect it from lightning. The solid bones of the head, interposed as a stout helmet between the brain, and the stroke of a vertical sun, and the large development of perspiratory apparatus in his skin, all eminently prove, that in man, so situated, some

divine nature operates in a direction antagonistic to external influences, which are otherwise calculated to deteriorate, or even probably destroy, the race. And, extending the illustration, it is also observable that individuals removed from a northern clime to contend with tropical heats, and alternate seasons of extreme dryness and rains, gradually exhibit, in an increasing sallowness of complexion, a decided tendency to assume that change in external appearance, best calculated to counteract the discomfort resulting from the effects of continued heat upon the human constitution.

Man, moulding his frame thus, to meet particular contingencies of situation, is evidently guided by some inexplicable law of intelligence within him, but which is not reason. A swallow building its nest of clay is said to be directed by instinct, and we are obliged to be satisfied with the indefinite information this conveys. And so we are told, quite as vaguely, that a vital instinct, independent of self-will, seems to operate in sustaining the physical economy of man. We live, and breathe, and have our being,—in life we enjoy the ends obtained,—but the moving agent, operating in all the wondrous machinery of the body, is hidden from conscious knowledge; and as regards what is, or may be, we speculate in some such manner as a race of blind men, enjoying the heat alone of the sun, might be supposed to do of the real nature and character of that luminary. It seems, indeed, as if we were in want of another sense to enable us fully to comprehend vitality, and to reduce to exact science its phenomena and laws; and my object in the observations I am now about to make, is to show that we really do possess, in a remarkable degree, some such power of receiving impressions, and conveying intelligence to the brain, just as sight communicates a knowledge of light, hearing does of sound, and touch of other qualities of matter not appreciable to sight or hearing. Independently of all the ordinary functions of digestion, I consider the stomach to be the seat of this occult sense, and that impressions received from external influences brought into contact with it, in the shape of food or medicine, are communicated to the brain, and are followed by corresponding reaction in the involuntary muscles or organisms of the body, just as motion follows the direction of reason, acting through and upon the muscles under the influence of the will.

It is of importance that I convey clearly my idea of the stomach's direct sensorial powers, for succeeding in this, I clear a way to knowledge for the general reader, by reducing the practice of medicine to a simple question of nutrition. As a general proposition, it is evident that physical existence is sustained by proper food and perfect digestion, but this does not all satisfy inquiry, as we still want some ultimate source or origin of organic integrity, on the one hand, and ask, further, what conscious principle selects the proper material of our frames from out the mass of food taken into the stomach. We see knowledge and power here exerted, using the mere organ, or bag, as a means to an end, just as reason looks out on the external world, through a curiously contrived instrument, called the eye. Of light, however, we have a tangible idea. Its negation, darkness, institutes an obvious comparison of condition. But as regards life, it is the experience of *being*, not a material conviction. Mere physical existence, of course, is not here meant; but that vital principle, which selects and forms its dwelling-place, literally from out the dust of the earth, but directly by the stomach, and through its instrumentality, exerting its dominant and superintending powers for the conservation and continuance of the body. And this exertion, in its normal and uninterrupted integrity, is as definite a sphere of feeling, in my opinion, as sight, or hearing, or touch. It communicates impressions to the brain, whether of appetite or of revulsion. It chooses between good and evil in what is offered as food for the use of the body. Life realizing itself in a physical form, must, in fact, first surround the simple idea with a stomach; and if, as many physiologists now affirm, during the embryonic period of man's transition, from a blood-cell to full development, he passes through all the various grades of animal life, from its lowest to the highest degree, the first and fundamental sense (to which all others are subsequent and supplemental) called into activity, must be the discriminating power of nutrition, that converts to the necessary wants of the growing system, whatever aliment is contained in the surrounding situation.*

* "The true colourless corpuscle (and it will be convenient to apply the term disc, or cell, to the *red* corpuscle) is much larger than the disc, and seems to be a round vesicle containing a number

For further reasoning upon this point I have no space, but must confine confirmatory remarks to a few anatomical details, drawing attention to the extensive nervous connection existing between the stomach and every other part of the body. In the first place, then, we have, communicating directly with the brain, the *par vagum*, in my opinion a nerve of sense; the sphere of which is the varied, often incongruous, and frequently noxious elements contained in the food taken; and its active operation, sensible, in the conscious instinct that selects from the crude mass, everything necessary for the support of the frame, and rejects the remainder, as incompatible with life and health. The relations of the stomach to the external world are far more numerous, and therefore exposed to greater contingencies of danger, than any other of the internal viscera; and it is natural to suppose that some extraordinary provision would be made, to meet the adverse circumstances inseparable from its situation, and the nature of its purposes. Improper food and poisonous drinks, by error or ignorance, are being constantly thrown into it, and, to distinguish between the good and evil amidst its varied contents, a power of discernment is absolutely required for the preservation and continuance of life. This, however, in whatever form developed, would amount to a perfect and proper sense; and in confirmation I may add, that the *par vagum* has its origin in that part of the brain, the *medulla oblongata*, from which the optic, the auditory, and the nerves of smell and touch arise. A reference to the analogous operation of vision will also assist the contemplation of this (necessarily so from its

of spherical granules imbedded in a gelatinous substance. This corpuscle has the property of spontaneous expansion and contraction, which forcibly reminds the observer of the contractions and expansions manifested by that singular microscopic animalcule, the *Amœba*, probably the very simplest of all organic beings. The Amœba is a single cell: it has no "organs" whatever, but crawls along the surface by extemporisising an arm or a leg out of its elastic substance, which arm or leg is speedily drawn in again, and fresh prolongations are thrown out; thus, as you watch it, you perceive it assuming an endless succession of forms, justifying the name of Proteus originally bestowed on it. So like the Amœba is the colourless blood-corpuscle, that many observers have not hesitated to adopt the opinion that these corpuscles are actually animalcules, and that our blood is a select vivarium."—*Blackwood's Magazine.*

situation) more occult sense, as I term it, of nutrition. Light is the sphere of the optic nerve, as food is of the *par vagum*, the office or function of which, apparent in the results of digestion, parallels sight, the active exertion of the other. But it must be perfectly understood that the distribution of the *par vagum* is not confined to the stomach. Innumerable subdivisions are sent to the heart, lungs, spleen, *œsophagus* or swallow, and to all the vessels, glands, and other adjoining organs. An eminent anatomist declares that it is "nearly as extensive in its connections as the sympathetic itself;" filaments of which, by the bye, accompany it in its remotest ramifications. I mention it here, as this extensive nervous communication is held to explain many morbid symptoms excited in remote parts by stomach disorders; such as the asthmatic attacks which accompany some forms of indigestion; the spasmodic affections of the heart, of the bowels, and not unfrequently of the limbs, from the presence of worms, or undigested food in the alimentary canal; the vomiting produced by tickling the top of the throat; and the relief from a sense of suffocation the act of vomiting affords, all of which are to be attributed to that mysterious response, which one organ makes to the call of another in extremity.*

Another specific phenomenon required to be considered, is the reflex character of the intercommunications between the stomach and the brain, in the first instance, by the *par vagum*, and secondarily through the affected brain, with the whole surface of the body, by the universal distribution of the sense of feeling, and with the deeper seated muscular tissue, by the motor nerves, and which would seem to explain the distant pains and spasms in the extremities, which frequently attend functional derangement, or organic irritation in the interior of the body, whilst, on the other hand, it also accounts for the grateful feeling of refreshment and general exhilaration, which in

* A familiar instance of the constant oversight, and evident exertion of a conservative instinct in the human system, is afforded in cases of children apparently choking. If two or three efforts of the muscles of the throat fail to dislodge the obstruction, a spontaneous act of vomiting comes to the rescue. Nature's solicitude in such cases seems to approach an agony of alarm, so prompt, so energetic, and withal so benign and effectual.

health follows a needed or genial repast. Physiologically considered, it is natural to suppose that these, and other sympathetic relations, more especially what are termed symptoms in disease, are due to sensations, produced in the latter case by some morbid excitement in the nerve of nutrition, communicated to the brain, and which reacts accordingly upon the general system. An instance is afforded in that very general symptom of an epidemic catarrh, of frequent occurrence in Natal, called "the sinkings," marked by considerable gastric or bilious disturbance, with excrutiating pains darting over one side of the head and face, along the track of the *super maxillary* nerve. It is the *tic doloreaux* of European experience. "The sinkings," or anxiety of the stomach, as I have heard it called, is an expressive term, indicative of the great depression of spirits always accompanying the attack, and an exaggerated condition of which, in dissipated, broken-down constitutions, is still more highly described as "the horrors," the popular term for *delirium tremens*.

The connection of the stomach with the great sympathetic nerve must next be noticed, as it illustrates a third kind or class of intercommunications between it and the various other organs of the body; of which, it is to be remembered, all functional action is removed entirely from the dominion of the will, as if of too great importance to be trusted to human caprice; and having, besides, operations of high moment to perform, which the unaided human mind would in vain endeavour to direct, or even to comprehend. It is usual to consider the great sympathetic as a peculiar nervous system in itself, supplemental to the brain and spinal marrow, and as its appearance in the body is characterised by numerous little bulbous expansions throughout its course, it is sometimes called the *ganglionic* nerve or system. The distribution of its numerous branches to be traced everywhere, is quite distinct, though always closely accompanying the nerves which arise from the brain and spinal marrow. It has no particular, but numerous origins in filaments which issue from the spinal marrow, through apertures in the vertebral column for the passage of nerves and vessels, and uniting in one continuous track of medullary matter, chiefly reposes on the heads of the ribs, and sides of the *vertebræ*, inside the trunk, thus connecting the viscera of the head, neck, the contents of the chest, the abdomen and pelvis (between

the hip-bones) into one nervous whole, and supposed mutually sympathetic circle; functionary weakness in any one organ, calling upon the common source of nervous energy to all, for the power necessary to reaction, so as to throw off the burden, or supply some other temporary need. Paralysis of the nerves of voluntary motion is generally partial and restricted, unlike the analogous interruption of nervous power to the involuntary muscles, by a palsied condition of the great sympathetic, which, by exerting a general depressing influence throughout all the organisms of the body, constitutes, in my opinion, the difference between cases of the former description, and those of low, nervous, or typhoid fever, the characteristic disease of Natal.

To recapitulate,—whilst the first class of nerves convey sensations to the brain, and communicate between the external world, and the sensorium of man; the second transmits the reactionary volitions of the mind; and the third, or sympathetic, regulates, uninterrupted by any external influences (save imperfect nutrition), the functions of the various involuntary muscles and organs of the body. And as may readily be presumed, the particular phenomena of each class of nerves very widely differ. For instance, the nerves of sensation and volition are only active whilst we are awake, while those issuing from, and belonging to the ganglionic system, continue muscular action during sleep, and even for some time after violence may have deprived a victim of all consciousness, or even life. Again, the nerves of sense each convey its own impressions to the brain, and none other. The optic is sensible to light alone, and is totally inactive as regards taste, or touch, or smell, these being severally, and as specially provided for by other nerves of sense. The effect of the whole, when excited in action, being to awake up consciousness, and to reduce the world around to the dominion of the mind. The nerves of voluntary motion act also with decided reference to human thought, as things done are only so much reason or folly eliminated in the brain, and through the medium of these nerves realised in active life. But the great sympathetic seems to be the medium of nervous communications, attended by no conscious light. The stomach, though as sensible to the nutritive character of food, by the operation of the *par vagum*, as the eye is to light, is yet insensible of its mere physical presence.

Whatever is swallowed, if we confine appetite within salutary bounds, consciousness neither feels nor knows anything of the process of digestion. It is a true observation, that if we feel we have a stomach, it is no good sign. So with other organs—the heart performs its office sensible to the stimulus of the blood, yet directed by no influence of the mind; the liver also performs its functions unwittingly to ourselves; and the air-cells of the lungs react upon the air, moved by a lively sense of what is their duty to do,—and still this evident consciousness has no part in our intellectual system.

We have the stomach, then, amply supplied with nerves of three distinctly different characters; one directing and controlling degludition; another enlightening the *sensoryum* as to the nutritive or noxious character of the food swallowed; and the third kind, derived from the great sympathetic, carrying on the function of digestion, as an ordinary process of instinctive organism. It can be easily understood, therefore, that when apt relations exist between the quantity, quality, and season of taking food, and the digestive powers of the individual, nutrition of the body, as the purpose of physical being, is fully secured. The infant at the breast best exhibits this happy accord of external supply of material support, with the internal wants of the human system; and the nurture and growth of the frame (wonderful indeed to contemplate, if not a matter of such every-day experience) shows how rapidly the constituents of the milk assimilate with, and are converted into the various tissues. Health, indeed, consists chiefly of an uninterrupted continuance of this natural advance in the stature and powers of the child; and a wise and good mother constitutes its best physician, to guard against deteriorated milk, or any excess of indulgence in her charge,—for, on the other hand, let it be observed, any error in these particulars produces immediate disorder, or, in contrasting language, ill-health. Proper nutrition, indeed, may be fairly considered to be equivalent to good health, and to have a closer relationship than mere cause and effect, as the terms are interchangeable with a reverse order, and we define one, when we describe the other; good health being as necessary to perfect nutrition, as perfect nutrition is to realise and constitute good health. Extend the illustration to more advanced years, and it will still be seen and admitted, that

to interrupted and deficient nutrition may be referred the rise and progress of every disease that affects the human body. Even external influences, such as exposure to cold and wet, or other climatic causes telling upon the frame, and well known to be followed by urgent symptoms, act only secondarily, for nature's first effort is to throw off the oppression by an extraordinary, but perfectly healthy, exertion; hence the value frequently of a nutritive cordial in aid, and hence the abuse of relief obtained, so commonly evinced in dram-drinking. It is only failing power that she succombs before these depressants for a time, and then significantly suspends nutrition in its primary seat (loss of appetite), so as to devote all her energies to the relief of the now evidently highly threatened subordinate function, say, of the skin, or of any other organ to which accident or constitution may have determined the greatest amount of irregularity of action. And be it always remembered, the physical link which thus so closely connects nutrition and health, is the *par vagum*, or nerve of sensation in the stomach; just as the economy of the optic nerve enables us to understand the analogous relations of light and vision, two distinct things, yet, after all, merely the mental and material aspects of one and the same idea.

Now it is very certain, that if all the information conveyed to the *sensorium* by the *par vagum* were to become part of active consciousness, little more than the most ordinary common sense would be required to secure a state of continual good health. Immediate knowledge of the particular effect upon the human frame of every kind of food, and this, derived from direct communications between the stomach and the brain, would establish an unerring instinct as regards the necessary supplies of nutrition; and the tree of life, of which it is said man might pluck, and eat, and live for ever, would really be within our reach. But gradual decay, and ultimate death, are elements in the very constitution of man, necessary to his prescribed progress, as the duration of life, thus defined, constitutes a temporary, but perfectly natural stage, for the development and trial of the, as yet, immature powers of that immaterial existence, which in human nature first separates itself distinctly from the material world. For this reason, it would seem, just as the action of the vital organs, on the one hand, is placed beyond the control of the mind, so as to protect life, from the caprice or sudden

impulse of self-will, so, on the other, to guard against life being indefinitely prolonged, provision has been made, that shuts out from conscious knowledge the key to perpetual youth ; otherwise that enlightened condition of the mind (did the impressions of the *par vagum* upon the brain excite tangible ideas of what was right, or required by circumstances, as does every other nerve of sense,) would naturally counteract decay from defective nutrition, and so defer death to the appointment of man's own will.

But to proceed with my general subject. It is very clear that food, simple in its nature, and moderate in quantity, when once swallowed, is felt no more, except in a general sense of refreshment and comfort, especially if the body has been somewhat exhausted by previous exertion. A still fuller meal of more stimulating viands, will further extend this grateful excitement to downright exhilaration, in which every part of the frame seems to share, *with the exception of the stomach itself*; an observation it is necessary to bear in mind, as it illustrates a most important principle in pathology, which is, that as the nerves of the stomach in a healthy state, acted upon by proper food, excite pleasing ideas and comfortable sensations throughout the whole system, so, by a converse operation, easily proved, the same nerves, unnaturally excited, or long abused, by improper or unwholesome diet, will produce in the mind a gloomy or irritable disposition, and in the body severe pains, without the stomach itself evincing any evidence of disorder or debility; and the least likely, perhaps, to be suspected of being the chief cause and actual seat of the more distantly described ailments complained of. In Natal especially, will this be found to be matter of every day experience. When enlightened as to its importance, common sense makes the preservation of health a personal duty, and imposes upon individuals the most careful attention to diet and regimen, to provide against those early indications, purely nervous, of general debility arising from defective nutrition, which are evinced in irritability of temper, despondency of mind, or disproportionate exhaustion occurring after every trifling exertion.

This characteristic unconsciousness is, however, no negation of nervous power or energy in the stomach. This would contradict its anatomical revelations. It seems to be owing to the fact that, in the case of the nerve of

nutrition, observation being necessarily restricted, unlike sight, or touch, or taste, excitement of the *par vagum* is rightly felt in the brain, and therefore not referred, as in these senses, to situations on the surface of the body, where external objects act upon them.* The local sensibility of the nerve of nutrition, indeed, is best described as a relation of conscious right, as to what is good and useful, for the requirements of the frame, in the digested or digestable food received into the stomach, and which reason sees realised in the strength and comfort that the body enjoys in consequence of this occult sense, constantly watching over its various wants and weaknesses, and guarding, with the most jealous care, against evil entering with the food from without. But this definition, of course, presumes the stomach in a state of perfectly natural health, and supplied with aliment, the very best adapted for the purposes of life; but in the present state of society and condition of man, save and except in the case of infants at the breast, this reciprocal fitness and aptness, between the stomach and food, can seldom, if ever, be fully secured and enjoyed. On the contrary this, the only natural source and assurance of bodily health, is continually being assailed and subverted, by ignorance or sensuality, leading to error or excess, in diet. The consequence, of course, is disorder and disease. The human frame, wanting in a proper supply of building materials, soon exhibits a failing energy; and life, a phenomenon of action and reaction between the opposing forces of vital and natural laws, gradually succumbs when the latter is allowed to prevail and predominate in the system, by careless neglect, or want of self-control, in the use and choice of food.

Having thus shown the intimate connection of perfect and natural nutrition, with life, in its normal excellence, the position suggests as a necessary consequence, and also as a practical conclusion, the immediate dependence of health upon proper digestion; understanding by health,

* Owing to this very natural misconception of the real seat of feeling, several weeks sometimes elapse before the idea of local pain in an amputated extremity is got rid of; and a patient will frequently wake up in agony, which no other evidence but his senses would convince him was not in its old situation, and still a part of his system.

that measure of vitality, or, more properly speaking, that enjoyment of life, which individual systems admit of, and which everybody must know differs in amount according to constitutional development and personal history. Nor let it be supposed, that in this general view of the origin and seat of the radical cause of all disease and physical debility, that I have overlooked or forgotten the numerous influences from without, frequently telling upon the human frame, such as extreme conditions or sudden changes in the weather, exposure to great privations, and long continued fatigue,—and which are known to affect health and threaten life, with consequences no less serious than those which attend upon deficient nutrition. But it is evident that, except in exposed situations, where the morbid results of continued residence may be calculated upon as in an exact science, that such causes of disease must be considered purely exceptional and outside general laws, their effects illustrating (as is usually the case), by eccentric deviation, the really natural laws of the physical economy of man. It should also, I think, be taken for granted, that reason has been chiefly given to guard the body against such sources of mischief, which are inseparable from a condition of the earth's surface, little adapted to the maintenance of human existence, with its long childhood, particular wants, and delicate organization. It is reason alone that enables man to overcome difficulties, and meet contingencies of situation, and which balances exposure by proper care or thought. Further, it perceives the dependence of good health upon proper nutrition, and therefore rightly concludes, that the most natural remedies and means of relief under circumstances of disorder and disease, ought to be looked for in connection with some controlling power over the office and functions of the stomach ; and which, with confirming force, is readily found in strict discipline and careful diet.

I do not ask, however, that these general propositions should be taken for more than they are worth. For my purpose, their value consists in being easily understood, and reconcilable with every man's observation, professional or otherwise ; and certainly the few pages I have to devote to the appearances and treatment of disease, precludes me from entering into any lengthened argument in defence or support of the simple *rationale* of disordered action in the human system, I have advanced, to satisfy many inquiring

minds who earnestly desire some insight into the matter. By admitting only one original source of disease—imperfect nutrition—all that might be said or written upon exciting or predisposing causes, is also in a great measure rendered unnecessary, for according to my view, every development of disordered action must primarily be considered in reference to its specific natural character,—whether it be one of reaction and cure, or otherwise—the negative of all this—one of depression and true disease; rather than enlarging the bounds of speculation, by including secondary considerations, which, in Natal, are found to have no value either in forming a judgment, or forwarding the cure. To satisfy professional feeling in favour of old opinion, I must state, however, that this pathological division of first symptoms, determining their natural character, has been adopted, chiefly because it appears to be the true key to the *diagnosis*, or interpretation of morbid action observed in this colony, but which, I am ready to acknowledge, would not be so directly applicable to circumstances of disease in Europe. There, rapid disorganisation of tissues, under disturbing influences of evident, and almost direct application, naturally enough suggest particular predisposition on the one hand, and immediately exciting causes on the other; and the detection of, and neutralizing these, constitute the greatest part of the cure. But it is very different in countries where acute inflammations are rare, and functional disturbance—not threatened organic lesion—constitute nine-tenths of the cases which come under the observation of the medical man, and where, too, experience finds that prostration and nervous exhaustion,—not arterial excitement and alteration of structure,—mark the attack and progress of serious disease. Under such circumstances, the constantly recurring idea is, that it is vital power in the abstract which is wanting, and that the system, without the *vis medicatrix naturæ*, is unable itself to initiate that system of healthy reaction which is the great characteristic of a sound constitution. And as the predisposition of the weakest frame is to renovate, if the materials required for structural wants are present, it is natural to conclude, that an opposite and adverse condition is due to some failure in the functional integrity of the stomach, or else to an insufficiency of nutriment, owing to ignorance and neglect in the choice of proper food. It then appears as if conscious vitality,

which in the first place selected its materials, and, in the womb, built up its future residence, gradually withdraws its sustaining influence ; and the body, left to the uncontrolled influence of mechanical and chemical laws, ceases to be adapted for the purposes of life, and is soon resolved into its original elements.

In Natal, the consideration of disease goes beyond immediate and direct causes, to the first relations between the external world and the physical economy of man. It is seldom there a question of failing parts, such as constitute local inflammations, but of the material integrity of the frame, generally, as the sphere of active existence. The idea of life surrounded by a stomach, admits of miscarriage, if the constantly recurring wear and tear of the *medium* ceases to be sustained by supplies of new matter. Around it must be found all the necessary constituents of form ; and wanting these, decay, and final disappearance, is the natural consequence. And these phenomena of gradual decline, are just those which, in Natal, press most frequently upon the attention of an observant medical man, who seeks to account for those anomalies of practise his experience here soon sets up against what he has been taught to do under apparently similar circumstances, and like symptoms of disordered action, when occurring in the northern hemisphere. The simulation of inflammatory disease by mere nervous debility, is sometimes most extraordinary, and the first caution to be given to newly-arrived practitioners, is to remember this ; and that the rule in Natal is so nurse up, and carefully stimulate, where the very same symptoms in England would require to be met by the severest course of depletion and low diet.

The conclusion from the premises is that, on the approach of disease, a normal effort, reaction, is either completed in cure, or determines an abnormal result, disorganisation, which occurs wherever physical structure is unequal to the task imposed, and organic texture is destroyed. In cases of the former kind (reaction), of course all the symptoms imply a natural return of the system to a healthy state, and being in effect curative, if watched will generally indicate the treatment best adapted to obtain, quickly and surely, the desired object. Thus a sick headache, relieving slowly some congested viscera, such as the liver or spleen, in the abdomen, is effectually aided by the operation of a mustard emetic ; and spontaneous

diarrhoeas, occasioned by acrid bile, or other vitiated secretions, are best moderated and checked by the exhibition of a brisk purgative.* It is also obvious, that continued healthy reaction indicates a favourable condition of the constitution, that only requires to be supported by proper diet, to ensure recovery by its own restorative efforts. And it is in this, and in the advantages frequently to be gained in cases such as I am referring to, by doing nothing, that the real secret of homœopathy consists, which, whatever its half-instructed admirers boast of on its behalf, can only be beneficial in these curative complaints, where nature is herself, as it were, her own family doctor. At all events, this is the only rational grounds by which the so-called cures can be explained, for to rely upon homœopathic globules to check the progress of organic disease, would be a fatal mistake. On the other hand, where imperfect organization readily converts the slightest impulse of reaction into active inflammation; and when rupture, not repair, of the delicate tissues of the frame is imminent, the symptoms of preternatural excitement require, not to be encouraged by slightly stimulant and nourishing food (caudle in fact), but sometimes a course of severe depletion, to meet these already adverse circumstances of constitutional strength. It is this which exposes what are called scrofulous habits to so much danger, and which, from the universality of the taint, constitutes the predisposition to so much in-

* For this purpose I invariably give, according to age of patient, three times as much of jalap as of calomel; say, for infants—one and three grains; to children between two and four years old—two grains and six; above that age, to about seven years—three grains and nine. To all after eight years of age, indifferently, but of course according to circumstances—the dose of four grains and twelve, or five and fifteen. So safe is the exhibition of this invaluable remedy, that in extreme cases, such as water on the brain (to which, during dentition, children are so very liable), I have given, for several days consecutively, two grains and six, respectively, of calomel and jalap, every six hours, and with the most successful results. As I have mentioned in the text mustard emetics, it will be as well to state, they consist of a table spoonful of common mustard, mixed in a tumbler of warm water, and taken if possible at a draught. Two or three successive tumblers of warm water assists the operation. Children, if they can be induced to do so, may take it with the greatest confidence as to its safety and efficacy.

flammatory disease in England. Whilst curiously enough, and which has led me to hesitate before ascribing it as above to imperfect organization, this kind of constitution is of all others the best adapted to meet the contingencies of every day life in Natal, and most calculated to resist the specific influence upon the frame induced by a residence in the southern hemisphere, where the tendency of organic action is to become languid, the mind hypochondriacal, and where the whole system appears to assume what may not improperly be called a nervous temperament, in contradistinction to the usually sanguine character and disposition of scrofulous habits.

That, indeed, which gives a marked specific character to early symptoms in these widely different constitutions, is the mental state of patients when first attacked. The curative form, or healthy reaction, calling upon the vital resources of the whole body, for the relief of some weak or injured part, occasions great depression, or lowness of spirits, owing to the general agitation aroused, and to the *sensorium* itself being conscious of the emergency. In Natal, this will be observed in every case—exceptions I leave to be considered by more advanced observation. And the advantage and utility of being early called in, which this disposition naturally suggests, will be appreciated by every honest medical man, who knows well, and has had frequently to deplore, the serious consequences of deferred attendance, from the delusive confidence which, on the other hand, as a rule, in the mother country, patients are so apt to entertain.

In the two countries respectively, therefore, we have to deal with two distinctly different classes of symptoms, related no further than in appearance, as speaking to the senses through the same nervous media, but often (and the caution cannot be too frequently repeated) productive of much harassing responsibility to the newly arrived practitioner, from the exaggerated fears of the patient, the anxious suggestions of friends, and his own doubts as to *diagnosis* (interpretation of symptoms), where anomalies, after all, do appear to disturb otherwise fixed conviction, however wrong—as, for example, every indication of violent inflammation in some internal organ or another, yet with a clean tongue, and the secretions natural, or easily brought under the control of medicine.

Of course, as people do die in Natal, as everywhere

else, symptoms, that may be deemed those of dissolution, not disease, occur. These also have an unmistakable specific character, which consists simply in a negation of, or the absence of all curative or reacting power in the system. From this cause I have known more than once, low nervous fevers of the most malignant character supervene upon simple fatigue, after no very long walk through the sandy streets of Durban. Under some circumstances—during gestation in women, for example,—a violent headache, with an almost paper-white and tremulous tongue, and constant sickness, bringing from off the stomach an acid watery secretion, will follow the slightest amount of exertion, and ends, not unfrequently, after further exhaustion consequent upon childbirth, in virulent puerperal fever. But in some seasons, and in some situations, the strongest of men succumb before the like indications of a total absence of reaction sufficient to carry the failing powers with rallying effect, over the critical want or weakness that stands between life and death. For instance, in cholera, the stage of collapse exhibits, in an extreme form, this exhausted condition of the system; and I consider the extreme prostration, so characteristic of Zulu fever, and of the low nervous fever of the up-country, to be a modification of the same constitutional bankruptcy, which, I believe, originates in, and is indicative of, imperfect or insufficient nutrition.

A tired horse soon rallies, and is ready for another long journey, by the mysterious influence upon his system a feed of oats produces. So in man, where previous exhaustion has occurred, a simple and moderate repast gives vigour, and a general sense of refreshment, to the whole body. And if we do not understand the operation, the commonest experience, at all events, is convinced of the fact. But the reverse aspect, where food fails to renovate, and even sleep—"tired nature's sweet restorer"—flies from the over-fatigued and exhausted frame, is scarcely ever considered in reference to the first great source of this vital deficiency—imperfect nutrition. Arguing from small things up to great principles, dram-drinkers certainly evince some approach towards a knowledge of the evil, but, of course, the habit is a mere instinct, illustrative of the curative suggestions of nature, and intended to provide for the temporary exhaustion of overworked man; but which, unfortunately, becomes too often abused, and is

made to subdue all sense of fatigue ; anticipating, by unnatural exhilaration, this wholesome check upon long continued expenditure of nervous power. As might therefore be supposed, it is disordered action in the stomach—some irregularity in its functional economy—which, by suspending nutrition, cuts off the supply of animal vigour, or nervous power, or vitality (by whatever name the *primum mobile* of life may be called), and the negation of which, by palsying or paralyzing the physical economy of the frame, leads in the latter case to certain but natural decease ; and in the former to a succession of collapses, with alternating efforts of reaction, until the careful nursing of a wise physician, or the undue interference of a foolish one, determines the final result.

But just as a genial repast will diffuse a pleasurable feeling throughout the whole body, without the stomach experiencing any unusual sensation, so very many serious complaints, mental and physical, have their origin in a depraved condition of the digestive powers, and yet the stomach will betray little participation in the uneasiness or pain thus excited. Impaired digestion, overlooked in the business engagements of active life, or masked by some apparently little connected ailment, often covers, for a length of time, a most insidious attack upon the structural integrity of the frame. In England, especially, where, as I have described, the nervous system is constitutionally apathetic, compared with the sensitiveness it assumes in Natal, it is surprising what an amount of disturbance in the functions of the alimentary canal is submitted to, with the greatest indifference, and neglect of remedial measures. In extreme instances and exceptional cases, certainly, there is sometimes seen an approach to that state of nervous agitation and alarm, which, early excited, proves so salutary a signal of approaching danger, whether from functional weakness in the stomach, or from the use of improper food. Such symptoms, derisively termed *hypochondriacal*,—frequently terminating, however, in insanity and suicide, when they follow upon long continued indigestion,—in young and excitable patients often induce in the system a species of mild *delirium tremens*. Some undefinable sensation invading a vital organ, conjures up a constant idea of impending death, and though, after a second or third attack, the stomach is found really to be the seat of the disorder, it is difficult at first to convince

patients that such is the fact, and that their fears are a mere morbid expression of a want, which otherwise, as healthy appetite, would conduce to that happy buoyancy of spirits, and confident enjoyment of life, which is characteristic of sound digestion and good health. After recovery, too, nothing is more natural than to smile at the disproportionate importance given to very trifling symptoms, as compared with the harmless conclusions eventuated by a simple course of cathartic medicines, and proper attention paid to regimen and diet.*

Before proceeding further, however, it will be necessary to observe, that the solitary principle upon which I base my practise of physic in Natal, admits of a very simple arrangement or order of disease in the human body. The progress of physical debility, from the delusions of *hypochondriasis* to the delirium and exhaustion of low nervous fever, may be conveniently, as it is naturally, divided into three well defined stages. Of these, the first is *nervous irritability*, where unnecessary anxiety, and frequent agitation of the mind, without sufficient cause, indicate something radically wrong in the system (bad food, fatigue, or some other oppression of exposure or climate), operating to diminish vitality at its source; although probably functional disturbance will be so trifling, that the symptoms, by all but the patient, will be ascribed to absurd fears, or even to mere want of sufficient self-control. The second stage is marked by an evident advance in constitutional debility, as the whole nervous system now seems invaded by a *morbid sensibility*, that perverts the natural functions of the various organs of the body, changing their usual unconscious operation into innumerable and ever-shifting pains, and other anomalous feelings, to account for which the closest examination fails to discover any alteration of structure in the several affected parts. The centre and

* This is the secret of the universal cures attributed to the use of Holloways, Morrison's, and all other life pills. Nervous hypochondriacs, suffering from the kind of *delirium tremens* described above, fancy themselves the victims of every disease known in the practise of physic, and many more besides. Those unfortunates really affected, are soon dead and buried, and nothing more is heard of them; but the greater majority get well, as a matter of course, after a little harmless purging, and live to express their gratitude, and ridiculous credulity, in the testimonials of supernatural success constantly being advertised.

seat of all this disturbance has long been known to be in the stomach; and as the remedies uniformly employed are such as promote digestion, or improve the state of it, whilst the strictest attention is enjoined as regards the use and choice of food, the singularly apt and significant term of *indigestion* has become to be generally employed to express the character and nature of a complaint, the most varied in its symptoms, and which affects, in a thousand ways, different people, according to their age, dispositions, and peculiar constitutions. The third and last stage is *delirium tremens*, a palsied condition of the whole nervous system, where all the functions of the body, disturbed, distracted, or distorted, paralyze reaction, and mental fears, indicative of life's extremity, prevail even over the evidences of the senses. Although ordinarily connected in the public mind with a long course of intemperate and irregular living, this admirable lesson of nature, *in vilo corporis*, serves a far more important purpose, by strikingly displaying the progress of that operation in a mortal economy which extinguishes, by withdrawing nervous power—the exciting spring of all organic action, and the first source of all bodily presence in an animated being. It depends, there can be little doubt, in the vast majority of cases, upon gradual disorganization (softening, for instance,) of the brain and spinal marrow; but as its symptoms sometimes appear immediately after a violent shock to the system, attended with considerable hemorrhage, and as also, in Natal, I have known it to occur even after severe depletion, where no compensating dietary measures were prescribed, the inference is, that the continued supply of a wanted constituent usually conveyed in the blood, has failed, either in whole or part, and, consequently, present or progressive decline in nervous power marks the character of the default.

Where the absence of some material excitement (remotely, the want of proper food) is so evidently the present cause, it is not difficult to conceive how *delirium tremens* may gradually supervene upon neglected or wrongly treated *indigestion*. Medicine contains as little nourishment as ardent spirits, and if ignorantly persisted in, without proper advice, to the neglect of sufficient support by food, as is too frequently the case, the same ill consequences will as surely follow, and are quite as likely to occur in extremely abstinent, as in dissipated

habits.* The principal difference consists in the form of the attack, for where, in the drunkard, taxed nature seems to adapt the whole economy of the frame to what has become a habit of constitution, but which immediately betrays itself on every occasion of unhealthy excitement; in the other extreme, of strict abstinence, the system seems reluctantly to yield to the benumbing influences of waning vitality, and then only through the progressive stages which mark the course of low typhoid, or nervous irritable fever, which affords ample opportunity for remedying the mischief incurred, by very little else than the careful administration of slightly stimulating and nutritious cordial drinks.

Particular circumstances or peculiar constitutions modify, sometimes very strangely, every symptom that may arise in the course of these three stages of nervous debility, and the reactionary efforts of nature to avoid impending dissolution, still further affect the appearances of disease as presented in Natal, but it is easy to divest these several stages of all adventitious or masked characters, and show them to be really nothing more than the ordinary phenomena of progressive exhaustion in a debilitated or worn out system, as I have here attempted to describe. For example, a very painfully exaggerated form of nervous irritability, common to all the three stages of general debility consequent upon imperfect nutrition, is *tic doloreaux*, better known in Natal as "the sinkings." In the majority of such cases, the course of the superior maxillary nerve is the seat of this harassing complaint; but it frequently appears in situations, and accompanied by symptoms, that lead the inexperienced medical man into very serious errors. Simulating active inflammation of the various vital organs, depletion and counter irritation, is the

* The miraculous intercourse with angels, and heavenly visions, accounts of which abound in the lives of every ascetic saint in the Roman calendar, are due entirely to this unsound condition of the brain and nervous system. In dissipated and vicious characters, affected in a similar manner, by their excesses having suspended or perverted the proper course of nutrition, the delusions under which they labour are, as might be expected, the reverse of celestial, and are well enough described under the popular designation of "blue devils."

natural suggestion ; and in consultation with new comers, I have often been amused at the evident reluctance with which they gave up, as it were, the evidence of their senses, to my expostulations that such a treatment would be as dangerous, and probably as fatal, as blood-letting and spare diet in *delirium tremens*. I have frequently known *tic doloreaux* occurring in the nerves of muscles situated over the regions of the lungs, of the heart, of the liver, and of the womb, invariably accompanied, according to sex, with hypochondriacism or hysteria, when exaggerated into perfect fever of nervous irritation, to be thus mistaken for inflammation of these several organs ; and long illnesses, where death has not actually resulted from wrong practise, have always been the consequence of this serious error. Such cases, however, yield readily enough to a treatment, the present object of which is to relieve a congested condition of the circulation in the brain. When called in early, or in simpler cases of more definite attacks of *tic doloreaux*, such as frequently accompany the catarrhal influenza of Natal, a prompt emetic of mustard, followed by a full dose, according to age, of calomel and jalap, with a generous, stimulant, but fluid diet, is all that will be necessary to subdue the more violent pain, and assure the patient, and the equally anxious friends, that the symptoms are well in hand, and the medical attendant is, as he ought to be, master of the position. In obstinate or protracted cases, the nitrate of potash, with acetate of ammonia in solution, given in the usual doses as a saline draught, will be found an excellent adjunct.

Returning to the consideration of the first stage of progressive decline in vital powers, the value of *hypochondriasis*, especially in early youth, as being usefully premonitory of some subtle evil threatening life, has been already commented upon ; but it is necessary to enlarge somewhat upon *Hysteria*, another form of nervous irritability consequent upon that great depressant of vital power—imperfect nutrition. Its frequent occurrence and periodical accession, in many female constitutions, may generally be traced to a neglect of some important dietary principle which their particular circumstances require. At least I have found in Natal specific relief afforded by ordering a stimulant farinaceous diet—like sago with wine, or gruel with a little brandy or gin—to be taken two or three times a-day. At the same time I give a calomel and jalap

powder (iv. and xii.) at bed-time, repeated when necessary ; or, when neglect has led to greatly exaggerated symptoms, every other night for a week. If more be required, the symptoms assumed will be those of low, nervous fever, with headache, white-coated, followed by a dry furred tongue, and suspended secretions, all of which, however, readily disappear before light nutritious caudle (cordial) drinks, and the same powders, given for three or four nights successively. Meat seems quite out of the question, as I have known more than once, a basin of beef tea, even, bring on, in very excitable constitutions, a decided return of the febrile symptoms, where all had been progressing favourably, but for the fears of anxious relatives, urging to improper lengths their endeavours to support failing strength. There is nothing my professional experience has taught me so much to dread in Natal, as officious or ignorant interference with nature's own efforts in disease, and the too kind nursing of friends, unsanctioned by a medical man's advice.

It may be as well also to remark here, that under circumstances of depressing nervous attacks appearing in women at critical times, I have noticed that an empty stomach, really craving for food, instead of exciting appetite, produces a singular languor, with hectic flushings of the skin, slight determination to the head, and actual nausea—symptoms, however, which disappear, as if by a charm, before a comfortable repast, the simplest form of which is an abernethy biscuit and a glass of good port wine. It really consists of collapse, or non-reaction in the system, after exhaustion from too protracted abstinence, and arises from a constitutional deficiency of vital power, such as I have before alluded to as frequently inducing low nervous fever, after a comparatively very trifling amount of exertion. Nursing mothers well know the value of occasional draughts of porter, to allay some very nearly allied disagreeable feelings in and about the region of the stomach, and which, in Natal, soon develop themselves in more decided forms of general nervous disorder, if this popular—I may say, almost instinctive—resort for relief, is either withheld, or its necessity overlooked. And further, the colicky pains and spasms occasioned by flatulence, often occurring in infants at the breast, should always be taken as indicative of impoverished milk, resulting from some error in diet on the part of the mother;

and who should immediately consider well the nature and character of her food, as therein will be found the best means of permanently benefitting the child.

In the female constitution one of the most distressing, as it is also the most general symptom of incipient decline in vital powers, is *leucorrhœa*, a weakness which will suggest itself by being peculiar to every woman's experience in Natal. It consists, in the first place, of a congested or irritable condition of the skin lining the womb and adjoining parts, and which throws out the usual secretion when in a state of nervous debility, for such I hold congestion to be. If neglected or aggravated by improper treatment, this first stage is certain to be followed by ulceration, with all the prostrating effect which the accompanying hectic fever always induces. For some years will the original cause, imperfect nutrition, and the constitutional disturbance it occasions, prey upon the system, not with the urgent active symptoms of disease, threatening to cut short life by an abnormal catastrophe, but most insidiously, as it were, accelerating natural dissolution by prematurely exhausting the vital strength of the frame. This is well shown in its last stage, which in every respect, excepting age, assumes the character of *bronchitis senilis*, or the chronic catarrh which generally proves so troublesome to old people. This has led, in several instances within my own knowledge, to very serious error, for naturally enough, on the appearance of the symptoms in the lungs, with constant cough and expectoration, the attention of the patient's friends is directed to a more important seat of disease, and to interrupted functions, attended with far more urgent and distressing symptoms. It is no wonder, therefore, that inexperienced observers should jump to the conclusion that consumptive disease is present; and this view, according best with popular ignorance of the specific difference between true *phthisis*, and the *bronchitis* of aged and worn-out constitutions, is usually the one taken, to the discredit of a far sounder, and therefore safer judgment, upon which to depend for relief. As the Colony progresses, of course, this source of error will disappear before increased facilities of obtaining proper medical advice. The *leucorrhœal* discharge arises from the ordinary relaxing effort of the climate upon the nervous system, telling in the form of congestion upon the circulation of the parts—the turgid and swollen blood-vessels

of the living membrane, especially the veins, being relieved by an exudation of the more watery parts of the blood. The same thing occurs when the inner surface of the nostrils, similarly affected by common *catarrh*, or cold, throws out a thin mucous discharge. The cure depends upon careful discipline and good diet. Without attention to these, medicine is of no avail; in fact, taken irregularly and at random, as is too frequently the case, it is worse than useless. Gentle horse exercise, short walks in the open air; at home, rest in a recumbent position, and always, the support afforded by the loop bandage; cheerful society, retiring early to bed, a cold hip bath at sunrise, are all necessary to cure. As health improves, the food, well selected and prepared, should be taken at longer intervals, until reduced to two principal meals a-day—one, a light farinaceous milk and sugar repast for breakfast, and in the evening a fuller and more substantial one of meat and vegetables, in the preparation of which hot aromatic condiments should be lavishly employed. Whilst any discharge remains, one five grain aloes and myrrh pill (equal parts) to be taken at bed-time every night, with a small basin of thin gruel or sago, well sweetened with two heaped-up table-spoonsful of the best white sugar, and to which three table-spoonsful of brandy or other spirit has been added, will be found good practise. In old chronic cases, where the bronchial irritation has commenced, in addition to the pill at bed-time, the aromatic gums, such as *myrrh*, *guiacum*, &c., given with mucilage, in the form of an emulsion, during the day, will be found very useful.

After the age of forty, women in Natal are exposed to very aggravated attacks of a nervous hysterical character, which every where, more or less, accompanies that critical revolution in the female constitution, usually called the change of life. Several cases that have come under my observation in this colony, were also marked by frequent and violent floodings, occurring at periods of seven or fourteen days, and extending over a period of from one to two years. This exhausting influence, as might naturally be supposed, is accompanied by great cerebral excitement and nervous alarm, the symptoms of which are of the same character with the indications of waning vital powers, exhibited in that form of *delirium tremens* which sometimes follows excessive hemorrhage during parturition, or

after severe operations. At the same time, when, in the first stage, the discharge of blood can be controlled by the application of a mechanical support to the parts, in the form of a simple loop bandage, consisting of two silk handkerchiefs, one passed loosely round the waist, to which the other is suspended, double behind, and the two ends brought between the legs to be fastened before, in nine cases out of ten the otherwise very threatening attack will be converted into a natural remedy for the specific form of congested circulation in the brain, which constitutes the remote cause of the disorder, and will prove to be the most effectual and speedy means of carrying our patient over the critical period of her life to which I have been alluding.

Under some circumstances the male constitution is also greatly strengthened and supported by the use of a similar kind of bandage. I have before drawn attention to the singular premonitory instinct which in Natal heralds approaching disease by an attack of nervousness. This, however, is only part of nature's care, for besides raising the alarm, she has provided a means of relief, that not only indicates the cause of the threatened disturbance, but points out the best remedial measures by which health may be reassured. In weak and ailing women, critical discharges, of a character allied to that I have just been referring to, occasion frequent irregularity in the ordinary monthly occurrence, which, when neglected as a symptom of something wrong in the system, leads to the establishment of a most debilitating *leucorrhœa*, ulceration of the inner surface, and even to a *prolapsus*, or coming down of the womb, which (being, like rupture, a displacement of the internal viscera of the abdomen) is a source of great nervous irritability, and the chief cause of much hysterical excitement. In men, we have an analogous determination in the same direction, of the curative effort of nature to relieve the gorged vessels of what is termed a torpid liver, by a discharge of blood. Hemorrhoids or piles is the appearance this assumes, and it must be within the experience of every one above the age of forty, how often some such attack has carried off, as it were, a heavy lethargic condition of the mental faculties, or proved the critical solution of a severe bilious disturbance, that would otherwise have merged into low nervous or typhoid fever. Constitutions upon which sudden meteorological changes,

or circumstances of accidental exposure, tell readily ; that is to say, in which the balance of the circulation between the surface covering of the body or the skin, and the internal organs of nutrition, instead of being easily and comfortably adjusted when disturbed by such malign influences, is attended with considerable agitation in the system ; there, in individuals so affected, will generally be found a predisposition to hemorrhoidal development ; and it is a remarkable fact, that melancholy or mental despondency is in a proportionate degree to the facility or difficulty that nature finds in effecting this means of relief. The *anus*, under these circumstances, constitutes a safety valve, where undue excitement in the human machine finds an escape in a discharge of blood from the hemorrhoidal veins.* But a system so disturbed, although thus relieved, is not freed from the primal cause of that languid circulation to which all the symptoms of oppression may be referred. The vital depressant, whatever it may consist of, whether defective nutrition, or continued exposure to cold and wet, will still continue to operate. It is only a question of constitution as to how long a time will elapse, before the overpowering disposition to sleep, and sense of swimming giddiness, in some individuals ; or the sleepless restlessness, and nervous agitations and pains which affect others, will return ; and with cumulative intensity on each successive occasion, owing to the increased debility which steadily proceeds, unless, indeed, proper means have been taken to arrest the adverse influence of the first causes themselves. To do this, nature's palliative, but painful resource, suggests a reasonable cure in active cathartic operations, which, by pressing upon the circulation in the

* In young subjects, where the peculiar developments of puberty have not been established, a more immediate relief to the obstructed circulation is obtained by frequent and violent hemorrhages from the nostrils. I have also observed in Natal, where constitutional predisposition seemed to determine the greatest pressure of congestion on to the viscera of the chest, that the mucous membrane lining the bronchial tube (as also, no doubt, that of the *swallow* and internal office of the stomach) would allow an escape from its minute vessels, of a considerable quantity of dark coloured and evidently congested blood, frequently alarming the patient's friends, and even sometimes misleading the medical attendant into the belief, that a really salutary effect, was a decided symptom of very serious mischief going on in the lungs.

bowels, for the necessary supply of fluid to liquidate foecal obstructions, as effectually, and certainly much more conveniently, disburden the gorged vessels of that excess of *serum*, or watery part of the blood, the superabundance of which constitutes the more immediate or present cause of the particular disturbance. At all events, getting rid of it by free evacuations from the bowels, appears to be the readiest and most effectual, as it certainly is the most popular means of obtaining relief. As, however, in the vast majority of such cases, ignorance or neglect leads oftener to a careless trust in the imperfect natural remedy of bleeding piles, the result is, that the fretted and exhausted parts gradually assume a permanently relaxed condition, which becomes a source of painful irritation ; and the subsidiary function of assisting nature under urgent circumstances, is also in a great measure lost. And thus it is, as age progresses, the Nemesis of neglected duty (as regards careful selection of food, and proper discipline of the body) makes its appearance in a habit of confirmed *indigestion* ; the whole economy of the human frame now seeming to share in that distrust of vital integrity (commonly called want of tone in the system) which is only partially evinced in *hysteria* and *hypochondriasis* ; whilst, as *delirium tremens*, a palsied condition of organic sensibility, nervous debility, arising from imperfect nutrition and exhausted powers, appears to have reached a stage still further advanced, in which, there can be little doubt, an incipient disorganization of the brain and spinal marrow, is ushering in a softened condition of the cerebral substance, so favorable for the development of serous apoplexy, or of a sudden mortal convulsion affecting the heart—the frequent present causes of death in subjects so affected.

With respect to individual attacks, as it is not possible for me at this time to follow up the discussion of the numerous questions which must naturally arise, from the consideration of so novel a view of the pathological relations between the human system, and the various ills to which it is heir to, I shall content myself with merely adding to what I have already said upon the subject, that every age and constitution is alike exposed to the recurrence of these several stages of progressive exhaustion ; and however different, according to special circumstances, the outward and visible developments may be, the specific oneness of remedial effect, produced by the same principles

and practise of medical treatment, applies to all cases; and further, the morbid results, as shown in *post mortem* examinations, where death has ensued, are so strikingly uniform as to form very conclusive evidence of the soundness of the conclusions I have arrived at, and ventured here to proclaim.*

To return. It is in such a relaxed condition of the *anus*, and adjoining parts, that the use of the loop bandage (the handkerchief passing between the legs, and secured before and behind to a second one round the loins) is of such paramount importance. The mechanical support afforded (as in the case of women, with an analogous state of the womb and its appendages), seems at once to reassure nature of attention being directed to her need; and the nervous agitation, which always accompanies visceral displacement even in the slightest degree, becomes almost immediately allayed, and the patient, besides, is placed in a more favorable situation to admit of the exhibition of a purgative course of medicine, should the other circumstances of the case require it.† But a far greater reason

* The morbid results will be found chiefly to be serous effusion in some one in particular, or several, of the cavities of the trunk; either of the pericardium, pleura, peritoneum, or into the ventricles of the brain. Softening of the texture of all the neighbouring parts, and depositions of matter in the substance of some one, or of several organs. The source of this latter seems to be the suppurating surface of a mucus membrane that has passed through the stage of congestion without reaction; softening and ulceration follow, and the *pus*, or matter exuded, becoming absorbed into, is conveyed by the veins to the different situations circumstances or constitution may determine it to. In lying-in women, for example, it is the lining membrane of the womb exposed to danger, and the breasts, where the matter is generally determined; in dysentery, again, it is the corresponding membrane of the bowels primary affected, and which, when it does end fatally, is almost always marked by abscess in the liver.

† It is good domestic practice, on the first appearance of hemorrhoidal irritation, to take at bed-time a full dose of calomel and jalap powder; and shortly after a small basin of thin sago or gruel, well sweetened with sugar, and to which two or three large spoonful of brandy should be added. If the attack be more than usually severe, rest, in a recumbent position, with warm fomentations, or a linseed meal poultice, will soon afford relief, providing that the diet be restricted to nourishing cordial drinks, and light meat soups, well seasoned with salt and pepper. A powder as above will be required every day the patient is confined to the couch.

with me for insisting upon the constant use of this bandage, whenever it is required, is that to hemorrhoidal irritation, long continued, and often wrongly treated, I attribute that truly distressing disease in man, as age advances, of enlarged prostate, a large gland surrounding the neck of the bladder, which increasing in size, from a morbid action repeatedly excited by the inflammation in the neighbouring parts, gradually encroaches upon and contracts the passage, so as to prevent the free discharge of urine. I may remark in proof, of the few aged men that have come under my care in Natal, more than one-half fell victims to a low fever of nervous irritation, chiefly to be attributed to the pain and difficulty occasioned by the cause here indicated.

About the age of puberty, the young of both sexes experience a very considerable commotion or excitement in the general system, indicating a critical change in the constitution. It is marked by new conditions imposed upon life, and accompanied by considerable changes in the appearance and physical economy of the body. The previous term of infancy has been a stage of preparation, and if nutrition has been properly sustained, the transition is easy and natural, and the advance made in the physical capabilities of being, reacts in producing a happy, hopeful state of the mind, and an increased buoyancy of spirits. On the other hand, *hysteria* and *hypochondriasis* tell a tale of defective vital powers, the opposite of all this; and although nature, when thus challenged at her very source, upon which so much depends,—the healthy vitality of the species,—comes readily to the rescue, and, in the vast majority of cases, the crisis is passed over, exciting little alarm, still the occurrence, more or less, of the nervous tribulation and alarm at the period I am referring to, sufficiently calls our earnest attention to the subject as parents, and ought to impose a careful attention to the diet of children to prepare them for a contingency to which we know they will be exposed. In Natal, at all events, any great amount of neglect is sure to be visited by serious sickness in a family, for to the want of vital power in consequence, is chiefly to be attributed those serious attacks of low nervous fever, which every year, during the first rains, is so very general among young people.*

* As far as I am able to judge from my own observations, the

The striking difference in the character of disease, as affecting children before or after the age of puberty, requires also to be mentioned here, as it affords opportunity of describing the principal symptoms which in Natal attend upon infantile disorder. In such it would seem that diminished vitality, almost always to be traced to imperfect nourishment, has the same tendency to occasion sluggishness in the circulation, which, in the low fever of more advanced youth, constitutes congestion, either in the brain, or on the lungs, or in the liver. But in children this does not affect so much the contained organs of the body, as it does the surface covering, or skin, and the continuation of the same, the mucus membrane lining the whole of the alimentary canal, from the lips to the lower bowel. The skin, externally and internally continuous, is in fact a kind of natural armour, protecting the entire system against all influences foreign to

severity of these periodical visitations depends greatly upon the rainy season, whether commencing early or late. If in September, the attacks are light, and the symptoms easily met by a calomel and jalap powder (according to age), night and morning, and during the day thin drinks of rice or barley water, or gruel, acidulated with lemons, and well sweetened with white sugar. After each powder a basin of sago, with a table spoonful or two of brandy or other spirit added. The attacks are more serious in a dry season, or when the rains appear late, as in November for instance. The treatment, however, is nearly the same. It will be as well, perhaps, to commence with an emetic of mustard, if it can be taken, otherwise of tartar emetic (antimonial wine). In case of great pain in the head, with delirium, the hair must be cut off, and a long swathe or bandage, first dipped in water, should be put on like a turban, and the heat and moisture confined by a flannel over-cap or bandage. If, as is sometimes the case, the oppression and pain is chiefly felt in the lungs, half an old calico sheet, dipped in water, doubled, and then bound round the chest, with a dry bandage over all, will give very great relief. Whenever such bandages show evidences of becoming dry, they should be replaced by fresh ones. The operation is that, under such circumstances, the head or chest, as the case may be (or both even may demand the treatment at the same time), is placed in a local warm bath, and the congested, and therefore labored, circulation in the organs contained, is directed to the skin. When the tongue shows evidences of the system resuming a healthy tone, by losing a certain tremulousness easily observed, and its furred yellowish-white surface begins to look red around the edges and tip, the *c. cum j.* powders may be gradually diminished, both in quantity and times of doses, and the farinaceous diet quietly changed into light meat broths and soups, well seasoned with salt and pepper.

its purposes or wants, and where sound and perfect, the body, in my opinion, is disease proof. Being subject, however, to vital laws of reproduction, its integrity depends on a constantly healthy change, to compensate for the ordinary wear and tear of life; and, as might therefore be expected, this all-enfolding and protecting product of organic economy is always the seat of first symptoms arising from defective or declining vitality. This seems particularly patent in childhood, when life is young, and when increase of stature and strength in the individual—not the continuance of the species—is the principle object of existence.

Making this observation the basis of a natural pathological law, we find in it a solution, accounting for the difference in character and situation of disease, as occurring before or after the age of puberty. In the latter case, the internal organs, tasked by new functions, and a superadded purpose, seem gradually to become exhausted in the process of developing a fresh representative, and sustaining the succession which mortality requires. A new interest is in fact created, and nature commences her retreat from the departing system, by a considerable diminution in the prophylactic sensitiveness of the skin; the increased energy of the contained viscera (a matter of nervous or vital power), now required by the altered circumstances of life, being evidently obtained at the expense of the external covering of the body.* It is found, therefore, that whilst

* Nervous power, the physical exponent of a more abstract vitality, is, in early youth, chiefly directed to the proper development of strength and stature, or is made to provide for the preservation of the system, when threatened by adverse circumstances of ill-health. After puberty is reached, however, it seems more concerned in the maintenance of the species than of the individual—with this object, as must be known to all, giving greater energy and activity to the reproductive organs, at the same time strengthening the mental faculties, and maturing reason, evidently for the economic purpose of providing for the bodily comfort of man, when nature, yielding to the laws of mortality, withdraws her conservative efforts, and ceases to sustain his frame by spontaneous exertions of self-restoration and renovation. The love of, and care for children, as the end of material organization, now becomes the ruling passion, and no one, I think, will be found to deny, that whilst birth and death constitute part of the machinery of life, parental instinct, as ensuring the continuance of the race, is a very sufficient substitute for the *vis medicatrix naturæ* of individual systems.

determination of blood (called by medical men congestion) to particular organs, as the brain, the lungs, the liver, the womb, &c., according to circumstances of accident or constitution, characterizes disease occurring in adults (and tending, according to geographical situation, to inflammation, or to nervous exhaustion), childhood, on the other hand, seems chiefly to be exposed to attacks of eruptive fever—scarlatina and measles, for example,—in the old country; and to catarrhal suffusion of the mucus membrane of the intestines (both, let it be remembered, being affections of true skin), in Natal. But, however unsatisfactory it may be to the reader, I cannot here enter further into the question, as to what peculiar climatic influences operate in the two hemispheres to produce this specific difference in situation and character of disease.* I must wait to have my position challenged, when I dare say ample opportunity will be given me, either to establish my own observation, or be corrected by the superior closeness or shrewdness of a more favoured experience.

As regards referring a particular catarrhal affection of children in Natal, to my first pathological division of disease—nervous irritability—I have drawn my conclusion from the really trivial nature of its attacks, compared with the extreme urgency of the symptoms; from the very simple remedies necessary for its relief, three-fourths of the cases that occur, requiring little more than the reactionary effort of the *vis medicatrix naturæ*; and lastly, from the very great mistakes in treatment, that (mislead by delusive, and therefore, in my opinion, purely nervous symptoms of violent inflammation being present) I have seen made, sometimes by over anxious friends, too frequently by officious nurses, but more fatally still, by inexperienced medical men. Blisters not unfrequently applied as counter

* As an instance—acute bronchitis, so general in England, may be said never to occur in Natal. Effusion of the minute air tubes and cells of the lungs with mucus, is certainly, in the latter country, the immediate cause of death in almost every case. But without positive disease present, this is always the process by which nature extinguishes life, and the character of *bronchitis senilis*, the specific affection of old age as a consequence of natural decay, very well illustrates the nature of the chief and most distressing symptom of chronic nervous weakness or constitutional exhaustion, as it does, also, the last stage of disease in Natal.

irritants, where they should have been avoided, as exaggerating by pain the nervous excitement already in excess ; and depleting by leeches, where physical debility, from imperfect nutrition, lay at the very bottom of the adverse condition of the system, which alone prevented nature herself from affecting a spontaneous cure.

At some seasons, when an epidemic influence seems to prevail over a wide extent of country, this infantile disorder is common enough.* The first symptoms are a notable loss of temper and of appetite, with flushed cheeks and a feverish skin. The little patient is fretful, uneasy, and soon completely prostrated by the attack. Recurring fits of vomiting now afford speedy, and almost spontaneous relief, where happy circumstances of constitution and proper care exist, by exciting perspiration, and thus relieving internal congestion, and also by removing from the stomach a quantity of thick slimy mucus, the secretion of which along the internal surface of the *esophagus*, or swallow, is the peculiar characteristic of the complaint. If, however, no spontaneous effort of this kind is made, a state of high continued fever sets in, accompanied with hurried and labored respiration, and a constant hard cough, as a quantity of the ropy, *tenacious* mucus, gathers at the top of the throat, and seems to threaten suffocation, by interrupting the admission of the air into the lungs. A paroxysm of choking, indeed, frequently affords partial relief, by exciting sympathetic vomiting, so as to get rid of a portion of the secretion ; but when the child is very young, or so weak as not to be able to take advantage of the effort, appalling fits of exhaustion and collapse will

* In the spring of the year, especially, a specific excitement in the whole surface covering of the body, internal and external, disturbs the general health, and a universal cold seems to be affecting the whole population of Natal, both male and female, old or young. It may seem a far-fetched analogy, though drawn from many well known facts in natural history, which induces me to consider that this phenomenon indicates, in a remarkable manner, a systematic provision, by which the cuticle, or outer coat of the skin, in man, is annually renewed. The value of this observation will be better estimated, when the reader's attention shall have been directed to the fundamental distinguishing characters of disease, as occurring in the northern or southern hemisphere, and most strikingly illustrated in the constitutional difference in the human frame, that predisposes, on the one hand, to scrofula, and on the other, to leprosy.

occur, which, at the time, seems to preclude all hope, and occasionally, even, leaves the impression that death has actually taken place.

Another observation must not be omitted, for where experience is wanting, the symptom it refers to contributes greatly to complicate the already very dubious character of the attack. This epidemic, especially in children more advanced in age, is ushered in by a specific excitement in the glands of the throat, which throb, and pain, and swell, like as is observant in many forms of eruptive fevers in England. In this colony, however, it will be found that the seat of the disturbance is confined to the skin, or mucus membrane covering these organs, which is highly congested, thickened, and runs easily into ulceration, which in bad cases not unusually extends through the whole course of the alimentary canal. On the other hand, in the old country, it is in the structural tissue of the glands, where mischief is most to be apprehended, from deep seated inflammation, disorganization, and abcess. It is also important to notice this difference in the seat of morbid action, for although *catarrhal influenza*, or, as I would rather call it, catarrh of nervous debility, corresponds in its relation, as a disease of childhood, with the eruptive fevers alluded to (more especially measles and scarlet fever), still the treatment required is as different as are the *pathognomonic* characters of the two attacks; one, as I regard it, being the consequence of too little reactive power in the system, whilst the virulence of the other seems to depend upon there being too much—at all events for the structural integrity of the neighbouring parts.

The most successful treatment of infantile epidemic catarrh, I have found to be (after an emetic of antimonial wine has done operating, and the stomach quiet,) to attend immediately to the support of the child's strength by proper food. With each powder of calomel and jalap (one and three grains, or two and six, according as the age is under or above two years, and given in urgent cases every six hours, in ordinary ones every twelve), it is necessary, therefore, to order as much thin gruel as the little patient will take, well sweetened with the best white sugar, and a few drops of brandy or other spirit added. A little of this food should also be given at intervals of two or three hours, particular attention being paid to its due continuance during the night, as I have noticed a frequent

cause of aggravation to be a collapse, occasioned by too long abstinence, while tired nurses slept. As soon as the white furred tongue showed the least symptom of improvement, the calomel was discontinued, and the doses of jalap reduced to three grains once or twice in the twenty-four hours. If, as is sometimes the case, the action upon the bowels should be excessive, or that *diarrhoea* from the first be present, it will not be necessary to administer more than one or two of the combined calomel and jalap powders; and even in the worst cases that have come under my care, it has never been necessary to exceed six. This remark is intended as a limitation, where direct medical advice is not available, inasmuch as that symptoms of nervous exhaustion, far more serious than the original disorder, may otherwise be occasioned by the operation of the medicine itself. It should always be borne in mind, that the most important part of the treatment is to support carefully the constitutional strength, from the very commencement of the attack; and this attended to, a cure, or at least a decided improvement, relieving all anxiety, will be effected in a few days. Such, indeed, is the truly trifling consequences to be apprehended from this epidemic catarrh, when its nature is properly understood (although I have known it throw the whole colony into a state of great alarm), that I have no doubt the little information here given to wives and mothers, will, for the future, constitute this infantile disorder one for nursery practise alone, in which, except in extreme cases of constitutional debility, the services of a medical man will never be required.

Here, also, is the proper place to observe, that a very nearly allied complaint, commonly, but most erroneously, called *croup*, will occasionally appear in young children, and though several cases will be found to occur together, and usually in autumn, still it is never so general as to require to be styled an epidemic. Its usual time of attack is in the early part of the night, and as its symptoms generally follow after a hearty meal, whilst one emetic sometimes is sufficient to effect a cure, convinces me that it is a mere convulsive affection, to which the constitution of children render them liable. Called in to a patient so attacked, an inexperienced observer might suppose that it was only to witness dissolution, to judge from the swollen face, the livid colour of the lips, the rapid pulse,

the apparently choking struggle for breath, and the hoarse, barking noise of the respiration, as the air forces its way through a spasmodically constricted *larynx* (top of the wind-pipe), and an accumulated secretion of mucus at the back of the throat, which, had it really been produced in the lungs, would certainly, long before the arrival of assistance, have put an end to life by *asphyxia*, or suffocation. The spasm appears, however, to be a true salutary effort of nature to relieve an oppressed system, by a paroxysm of choking, always provocative of violent heaving, and the rejection of the contents of the stomach and swallow. From the inner surface of these organs, a great quantity of thick viscid mucus, or phlegm, is thrown out, produced under some influences of depression (bad weather, improper food, or both combined,) acting upon the easily excited and irritable constitution of children. Of course, as this morbid secretion threatens to close with an impervious lute the mouths of the minute vessels which take up, and convey to the blood, the nutritive juices of the food, nature, conscious of her extremity, takes early and effective measures of relief ; and I could not have a better illustration of the conservative instinct, which in favored constitutions and situations, adapted for its due development and operation, protects the human system from organic (that is, inflammatory) disease, by thus exaggerating functional (that is, nervous) disorder, on the earliest approach of any malign influences obnoxious to health and life. And such is the case with the urgent, yet, for their purpose, safe and efficient symptoms of the choking *croup* of Natal, which, with all the threatening appearances of its serious and much dreaded *synonyme* in Europe, is nothing more than a mere respiratory convulsion, relieved by an act of vomiting, which itself excites, and having no inflammatory tendency, but just the contrary ; nor, indeed, can it scarcely, with propriety, be called an affection of the wind-pipe at all. The spasm of the *larynx* is a mere symptom, and that a curative one. Reason has no other resource, indeed, than to produce, as soon as possible, like effects on the contents of the stomach.

As I have said, an antimonial emetic will relieve immediately all the urgent symptoms, but it should be followed by a calomel and jalap powder as soon as the, stomach will bear it, which will be in about an hour afterwards.

Should vomiting, however, be excited again, it makes little difference, as a cathartic operation is almost sure to follow. Any other treatment than this I have found only aggravates the disorder. Mustard poultices, or oily embrocations to the throat, increase the irritation and inconvenience of the little patient, and weaken the natural power of re-action. At the same time, something considerably more important than the emetic and c. *cum j.* powder is required to restore health. Nutritious food, of the proper kind, is again the principal thing to be attended to, or the consequence will be, that a chronic form of the original cause of illness—and which, by the bye, is the same in *catarrhal influenza* as in this *pseudocroup*,—a relaxed and congested condition of the mucus membrane, or skin lining the swallow and stomach, is established in the system, and, in the well-known form of *hooping-cough*, will for weeks, or even months, severely try, or even perhaps exhaust, the constitutional powers altogether. I can here only observe, that a diluted milk and sugar diet, with well sweetened farinaceous drinks during the day, is absolutely necessary in these cases. Liquorice in linseed tea, or barley sugar in rice water, are medicaments of this description that children will seldom refuse. Where more than usual obstinacy in obtaining relief occurs, I have found that a teaspoonful of antimonial wine at bed-time aids greatly in relieving the stomach of that burden of viscid phlegm which excites the convulsive efforts to throw it off; whilst a small teaspoonful of common carbonate of soda, given in the morning, seems to diminish very considerably its secretion during the day. If, however, parents will pay attention to these few words of advice, as to the proper character of every thing the child eats, there is little fear to be apprehended from this otherwise distressing and obstinate complaint. But one observation more—that this catarrhal affection of childhood occurring on the coast, is much more apt, in weakened habits, to run into an ulcerated condition of the mucus membrane, extending throughout the whole alimentary canal, rather than to assume the form of hooping cough, which is generally the case in the middle and upper districts of Natal. The cure, however, consists in the same attention to proper diet, of a character such as I have just described, with the addition of a few drops of spirit in the food two or three

times a-day. Change of air I was also in the habit of recommending early, before the *marasmus*, or characteristic wasting away of the frame in this disease, had made much progress. All these catarrhal affections—the epidemic influenza, the *pseudo-croup*, and their chronic form, hooping-cough,—seem to be the attendant phenomena upon exaggerated or abortive efforts, otherwise perfectly natural, by which the system throws off, or protects itself from, some depressing influence. As a warm bath relieves the uncomfortable feelings of general febrile oppression, by equalizing a disturbed balance in the circulation—encouraging it in the external skin, on the one hand; and, on the other, relieving torpor or congestion in the internal organs—so I conceive nature acts in a somewhat analogous manner, by determining the blood, on occasions of emergency, to the moist, warm, and consequently more easily relaxed, internal skin, lining the alimentary canal; thus exciting a salutary reaction in favor of the more important organs and viscera of the abdomen, serious consequences to which would be likely to ensue, were no relief found for a distended and overgorged condition of their delicate blood-vessels. This curative operation in the human system is indeed the most general one nature employs, and is the very same, whether prominently developed in the common catarrhal symptoms of relaxed uvula and swollen tonsils, or in the enlarged and painful protusions of the skin and loose cellular tissue enveloping the hemorrhoidal veins, constituting what is commonly known as the piles. The same kind of local irritation, and, no doubt, nervous excitement of the mucus membrane immediately around the entrance of the *swallow*, into the bag of the stomach, also gives rise to the so-called *heart-burn* of adult age; and frequently, in Natal, I have seen in children severe, and apparently very serious symptoms, which in England would have been considered those of *gastritis*, or inflammation of the stomach (high fever, excessive pain in the region, and constant vomiting of a green acid fluid), that could only be attributed to the same simple cause, for when, as I have known it to be, treated as inflammation, a bad case was the certain consequence, but which in others easily gave way before a dose of castor oil, or a calomel and jalap powder, an aromatic mixture, with a few drops of nitrous ether, and a mustard poultice applied to the pit of the stomach—not forgetting always,

after the operation of the cathartic, to prescribe a cup of sweet cordial gruel, or thin sago.*

In Natal, after the age of puberty, the change in character of disordered action in the human system is striking and decided. A natural operation, consisting of restorative reaction, in the one case, is seldom, with proper care, insufficient to re-establish health; in the other, although the same conservative instinct is roused by morbid influences telling on the frame, it appears, from some cause or other, to fail in the desired purpose, and only succeeds in establishing a peculiar febrile habit in the system, usually accompanied by symptoms which in England would describe an attack of indigestion, and in the early stage of which *hysteria*, or *hypochondriasis*, as the sex may be, is the most prominent feature. But, as I have before had occasion to remark, first symptoms in Natal reflect the mortal consequences of flagging vitality in a much more lively manner than by exciting vague fears alone. Simulations of serious organic disease, expressed in actual pain and arterial excitement, frequently accompany the most trifling functional disorder, and to such an extent, that not only the patient, but the medical attendant himself may be deceived by the apparently urgent nature of the attack. There is also an important element, in these nervous exaggerations I would not have overlooked, as it is the real source of danger, and great first cause of all serious disease. Nervous irritability, when once established in the system, by any debilitating cause or injury, if not allayed in one paroxysm of effort—that is to say, resolved in healthy reaction—in my opinion constitutes *indigestion* in a general sense, without reference to modifying influences giving to it particular forms and character.

The simplest form of this constitutional fever of irritation is that restlessness, and nervous excitement of mind and body, induced by over-fatigue, and also, be it added, by over-tasked thought. When unaided nature is unequal to renovate the tired frame, the default gives rise to a

* I have a great prejudice against giving children arrowroot, especially during illness. On weak stomachs it easily runs into a thin, acid state, highly irritating to the bowels, occasioning severe griping pains, and a spasmotic constriction not easily overcome by medicine, and which otherwise, perhaps, might not have been required.

peculiar agitation in the system, of one day's duration, called from that circumstance *ephemera*. This phenomenon of transient disorder is, by the masses, little considered. The careless, by dram-drinking, and the sober, by that fact alone, recover so soon from temporary exhaustion, that they may be said to be totally unconscious of the effort of reaction natural to the circumstances. The hard student, the racked gamester, and the nightly dissipated of both sexes, however, so frequently suffer from a retributive experience, of such a form, and with such intensity, as to impose a kind of curative discipline, and sometimes necessitates medical advice. Hence it is that the one day fever, or *ephemera*, takes its place in European nosology, but is still regarded as of very trifling importance, and even regarded by some as an unnecessary refinement in the classification of disease. But diminished vital energy is consequent upon other causes besides mere fatigue—such, for example, as the failure of the physical sources of nervous power, either from the use of bad food, or from a palsied condition of the proper nerve of nutrition, the *par vagum*, and which would necessarily lead to defective or imperfect digestion of even the very best food. In either of these cases, successful reaction by one effort of nature cannot be expected, whilst it is evident, also, from constant experience, that a succession of endeavours to throw off or correct the morbid impression will be made by the conservative instinct, the *vis medicatrix* of the human economy. These, as they partake of the nature, will also exhibit somewhat of the character observed in the limited course of an *ephemera*; but instead of one, and that successful, there will be a continued series of abortive daily efforts, and therefore, unless some extraordinary rally takes place, as each succeeding day's attack can only be an aggravation of the preceding one, it is obvious, under the circumstances, that debility would, as it were, feed upon itself, and life become merely a protracted dissolution.

So far, nervous disorder or defect has alone been considered, in reference to the restorative powers of nature, but it now requires to be noted, that although the brain and spinal marrow control the distribution of vital force throughout the frame, yet it is in the blood that its chief source and supply is to be found. The fact is, that the cerebral and sanguinous systems share between them the responsibility of sustaining life, which may be said, physi-

cally, to consist of the alternate action and reaction upon each other of these two material agencies, apparently of equal but opposite value, always engaged in a contending yet consenting exercise of the supreme power. In a few words—on the one hand, we have the circulation carried on by the *sensibility* of the heart and arteries to their contents; whilst, on the other, we have the brain depending upon the healthy state of the blood for all its vital energy and mysterious force. This leads to the inference that nervous exhaustion, under ordinary circumstances, is rallied, and nervous vigour restored, by the sanguinous system conveying to the brain and spinal marrow, a certain *pabulum vitae*, or vital nourishment, which is eliminated there from the blood, and which the blood had received in the first place from the products of digestion and respiration. It seems also clear, that the first efforts of nature suffering from exhaustion is to impede the otherwise free and rapid passage of the blood through the brain, as if, by accumulation, it would compensate quality ; and to the congestion thus occasioned, is to be referred the heaviness, sleepiness, giddiness, throbbing pain, and all the other symptoms of obstructed circulation—from natural but heavy sleep after a long day's exertion, to the whole train of disagreeable symptoms that attend upon what is popularly known as determination of blood to the brain.* Reaction again from this condition, includes, of course, the ordinary phenomenon of awakening from sleep, when, a provision of nervous power having been made during the night's repose for the forthcoming requirements of the day, the stimulus of light and warmth which attend upon the rising sun, once more rouses to active exercise the previous dormant or exhausted faculties of the mind and body. To throw off, however, the unnatural oppression of a retarded circulation, more than the ordinary re-agency is required. The emergency of the brain, threatened with serous or sanguinous apoplexy from congestion, imme-

* This effect upon the general system is produced by a contraction (which in fever amounts to spasm) in the calibre of the capillary tubes—minute vessels, neither arteries nor veins, but which establishes the communication between them. I believe these capillaries to be of the same nervous nature as the arachnoid membrane has been proved to be, and to constitute a serous double cap, enclosing a canal, which receives the opposed extremities of the venous and arterial systems.

diately applies to its own relief all the nervous power it can collect; for this purpose, therefore, it temporarily withdraws the usual supply of functional energy from the various other organs of the body, and thus occasions that general sense of debility which accompanies every form and degree of disturbed function occurring in the human frame. This operation prolonged leads to a general collapse, or complete prostration of vital power, the effect of which is to produce in the skin a sensation of shivering cold, that characterizes the first stage of a fever paroxysm. But when, from this abnormal and torpid state of organic life, nature's economy has garnered up a sufficiency of nervous power, the whole seems at once to be poured out exclusively upon the machinery of the circulation, producing a corresponding intensity of reaction. A burning glow over the whole frame now succeeds the freezing chills of the former stage, and a general excitement, proportionate to the previous collapse, ensues, until, at length, an universal perspiration breaks out, which distinguishes the third or last stage of the attack, and marks the return of the system to its ordinary state; but (and to my readers the most important point of all) *plus*, or *minus*, constitutional strength, as circumstances, fortunate or otherwise, have determined the character, whether successful or abortive, of the restorative effort just made by the *vis medicatrix naturæ*.

The specific character of *ephemera*, confined to a single development of febrile phenomena, limited to a duration of twenty-four hours, and then resolving itself into usual health, if properly considered, is an instructive lecture, in nature's own language, upon disease in general, and its proper treatment. Whilst it evidently is the radical type of every known form of fever, it is in itself a purely natural operation, and a normal element in man's physical economy, provided, not only to meet exigencies of constant occurrence in active existence, but also to direct and guide him in the cure of actual abnormal disturbance, when it does occur in his system. The unity of all disease, as it has been called, has been a recognized principle in pathology from the time of Hippocrates, or four thousand years since; but this is only a partial recognition of a great truth, the principal value of which, for practical purposes, consists in knowing, that this unity is based upon the oneness of conservative reaction, whether, on the

one hand, it be resolved at once in cure, or, on the other, exhausts vitality by repeated paroxysms of daily effort, endeavouring in vain to throw off some overpowering oppression.* And this attempted elucidation of a grand principle upon which the treatment of disease ought to be based, is further illustrated and confirmed by a reference to the periodic attacks of fever paroxysms, which, however eccentric, are most remarkably regular in the periods of their return, the term being always a multiple of the one day *ephemera*; the appearance and disappearance of the recurring symptoms being also, as usual, included in one revolution of twenty-four hours, and so far corresponds in character to the measured conditions of alternate activity and repose in ordinary daily experience, and which more than suggest, for the phenomena go far to demonstrate the same direct influence upon diseased, as upon healthy action, of that fundamental law of animal economy, which, by an accumulation of nervous power during an interval of rest, provides for the supply of a succeeding term of exertion. Every one knows that extraordinary fatigue induces sleep, as a means of speedily restoring the disturbed balance occasioned by undue expenditure, and we have also seen how the relief of still more serious interference with constitutional strength is sometimes effected by a spontaneous exertion of one day's duration; which, with every symptom of disordered action, proves to be, in the result, as natural an operation as is the process, often protracted and severe, of parturition. So frequent, however, is the recurrence of this adjusting or compensating operation in the system (and which in its mildest form is scarcely to be distinguished or separable from the ordinary phenomenon of a good night's rest), that in the vast majority of instances it is passed over with thoughtless indifference, as regards an otherwise most remarkable provision to guard against continual and serious illness, and in perfect ignorance of a great therapeutic principle involved,

* The various modifications and different appearances of the numerous diseases that afflict humanity, depend primarily upon the sphere of morbid action being either in the nervous, or in the sanguinous system; and secondly, upon the seat or situation of the most prominent and urgent symptoms; the brain, lungs, liver, and other viscera, when abnormally excited by several exhibiting phenomena of a special character, depending upon their different functions.

that in the suggestions of this natural effort is to be found the ways and means of obtaining the speediest relief and cure in all other disturbed conditions of the human frame.

These remarks upon a first principle in my practise of medicine, are intended to introduce, under the term *indigestion*, a popular account of a species of nervous excitement, hitherto undescribed, but very common in Natal. The name may be considered too vague and general, but I think not more so than *inflammation*, which is employed to denote very opposite conditions of disordered action in the sanguinous system. At all events, it suits my purpose better, and conveys a juster notion of my meaning, than if I had resolved the radical evil into diseases as numerous as are the symptoms complained of, and which, after all, consist chiefly of the suggestions of a morbid sensibility, not more real than are the allied delusions of *delirium tremens*, when, in a stage further advanced, the optic nerve becomes affected by the uninterrupted decline of vital power. Its presence, in my opinion, is altogether owing to constitutional debility, and is only another form of those efforts of reaction which, in childhood, so successfully resist the approach of disease by simple catarrhal resolution, but which, after puberty, seems to fall lamentably short of this natural conservative operation. It is most interesting and instructive to note the effects upon the human constitution, when, after unusual fatigue, or accident, or great mental anxiety, the usual *ephemera* of one day's duration and cure, becomes a continued habit of body, and daily, more or less, symptoms of lassitude and congestion, accompanied with great prostration, are followed by flushing heats and excitement in two protracted paroxysms, and which are coincident with, and evidently depend upon, the natural wane and increase of vital power, corresponding with the alternations of day and night. That which, in fact, struck me from the first, in my observation of disease in Natal, was the methodic manner a progressive collapse of the system seemed invariably to commence at the culmination of a stage of excitement, when the sun declined in the west, and which gradually, but almost imperceptibly, advanced to a distinct and determinate crisis of extreme exhaustion, generally occurring about three o'clock in early morning, but as the weakness of the patient increased, drawing nearer and nearer to midnight. This

phenomenon of disordered action in the human system, having many of the symptoms of a regular fever attack, I could not, however, satisfactorily resolve into any of the recognized forms of that kind of disease. If to any, it would have been referred to the continued class, in the first stage of excitement being frequently undistinguishable from it, but which, in the succeeding collapse, at once put an end to the threatened mischief of inflammation, by assuming a character just the reverse, of low typhoid debility. My first conclusion, therefore, was, that the indications constituted a new and particular type; but in attempting to define it, in cases where the specific alternations were most prominent, I found that I only described the ordinary form of mild remittent fever, in a manner that would lead professional readers (who of course will be the judges of the soundness of my views), to believe that this new fever was merely a refinement of observation, and based upon no real differences. As, however, this ebb and flow of nervous power, continued long after every symptom of specific fever had disappeared, and all the functions of the body had resumed their ordinary operation; and observing, further, that in cases of fatal relapse, death ensued entirely from exhaustion, without the least effort of reaction, and not from any return of the original fever attack, my next resort for some explanation was to suppose it possible that an *idiopathic* (that is to say, spontaneous or primary) fever might exist in the system, at one and the same time with a secondary or symptomatic one; and for some time I considered that all the modifications of appearance in the course of disease in Natal, as differing from what was observed in other countries, might be accounted for, by supposing that the true attack was attended with a kind of hectic, or fever of debility, which supplemented and modified the ordinary symptoms. This failed, however, to satisfy me altogether, for it is most surprising to observe the trifling, and therefore numerous, causes that in Natal are sufficient to occasion the development of this peculiar daily fever of alternate nervous exaltation and depression. And where the primary cause is insignificant, it is not pathologically correct to consider the more serious accompaniment as a mere secondary symptom. In such a case the proper relation is that of an exciting cause to the disease produced. Such considerations as these, and the well known fact that nervous

disorder generally is exposed to great exaggeration in South Africa—a mystery which seemed to admit of some local solution—led me, with this object, to examine the subject further, hoping, at all events, that light might somewhere appear.

The simplest and best view of this morbid condition, in the present state of knowledge, is obtained by generalizing the most prominent symptoms, which I have therefore attempted, and called the result *indigestion*, which speaks to the experience of every one, and sufficiently denotes the pathological character of a well marked disorder very common in Natal. If such a definition be objected to as loose and general, all I can say is, that, on the other hand, it would require, not an epitome only, but a lucid account of the whole physical economy of man, to explain the origin, development, and effect of this particular disordered action in the system, inasmuch as it involves nothing less than a negation of vitality; and which, as an important indication of threatened decline, immediately appears, like a warning cloud in a clear sky, whenever the proper balance between the supply of nervous power, and its expenditure in organic action, is, by any morbid interference, suspended or disturbed. A broad principle, however, which I venture to affirm will assist in the better understanding my idea of *indigestion* in Natal. Nature, speaking through its symptoms, states plainly, that whatever may be its origin, and however it may be developed, or wherever its ultimate effects are seated, the operation, from first to last, is purely nervous, beginning in *hypochondriasis*, and ending (where not more abruptly terminated in febrile spasm or organic convulsion) in *palsy*. We find, also, the treatment required to effect a cure, is such that is best calculated to introduce (still through the medium of the stomach) an extraordinarily increased supply of nervous power, which is eliminated, as I have before said, from the blood, during its passage through the brain. This, of course, suggests a previous insufficiency, and a failure of the most important product of digestion, although the evil may be the consequence of some general depressant, and the stomach the least seriously affected of all the organs of the body. The latter, however, being the chief seat of curative operations, and the symptoms of which—loss of appetite, heart-burn, nausea, &c.—involve a temporary suspension of its ordinary functions, it is not

surprising to find that this untoward condition of the system should become to be generally known, and best described for popular purposes, as *indigestion*.

I have before had occasion to remark what trivial causes are sufficient to excite in the system, under some circumstances, this peculiar fever of daily recurrence. But besides fatigue, or over-tasked thought, or slight accidental injuries, exhaustion of nervous power may, and in a number of cases does, depend upon an inadequate supply for the wants of the system, and which may be traced directly to its source in insufficient or improper food. Again, many meteorological causes (of which the effect of cold upon the human frame, especially when conjoined with much moisture in the atmosphere, affords useful illustration), constitute other adverse relations of life with external nature, and which always occasion a degree of excitement proportionate to the mischief to be met and remedied, and the constitutional strength of the system exposed to the attack; for it requires to be remembered, as a natural law, that extraordinary exertion in the nervous system is always followed by corresponding depression, in exact accordance with the normal phenomena of alternate activity and repose, imposed upon all animal existence, and observed in the daily experience of life. The symptoms will even appear to be sometimes part of the natural economy, as when attending upon a critical change in the constitution. At puberty, for example, we have a shadow in *hysteria* and *hypochondriasis*, that tells of a substantive source of weakness arising from the very working of the machine itself. It also proves the exquisite balance of the vital powers, that even a preponderating moral phenomenon (when the mind is being fully developed), diverts so much from the ordinary distribution of nervous power, as to occasion in the system considerable functional disorder. Puberty, however, having become an accomplished fact, and the charge of the individual having been given over by nature to reason, we find the failings of ignorance, the excesses of passion, accidents, and other influences of external action, rapidly impair constitutional strength, by taxing it to the utmost, in these constantly required efforts of daily adjustment, to preserve a healthy equilibrium between the nervous and sanguinous reactions.

Under these circumstances, the value of a very delicate metre of nutrition, telling, not perhaps to the eye, but to

individual feeling, how the matter stands as regards present condition and future welfare, must be apparent; and such in fact the symptoms of indigestion are, and evidently intended to be so, in the provident design upon which the animal frame has been constructed. And in this the happiness of the brute creation has been as much consulted as man's, for I have very little doubt, in case of threatened illness respectively, that *instinct* will prompt to a much more careful attention to nature's hints, conveyed through the medium of a disturbed digestion, than is found generally to be the case in man, left to the uncertain guidance of his half-instructed and wilful *reason*. From this stand-point, also, *indigestion* becomes one aspect, and of course not the favorable one, of the fluctuating condition of constitutional strength, which (reserving any difference of degree as age advances, or the depressing influences of epidemic or accidental causes) always depends upon man's own care or carelessness in matters relating to his diet, and personal cleanliness.

And as healthy reaction, eventuating in cure, indicates conservative vigour in a sound body, so, on the other hand, *nervous indigestion* in Natal (to which I am confining my observations) is the physical expression given to constitutional debility, when the general system, unequal to establish altogether the restorative process, yet true to the economic law which directs the effort, still continues its endeavours to throw off whatever vital depressant is operating adversely to the material interests of the frame. Developed in the first instance as *hysteria*, or *hypochondriasis*, this specific debility of the general system betrays immediately its nervous connection. Further advanced, the excited fears of a system, threatened with deficiency of vital power, if not relieved by careful attention to diet, soon realize themselves in actual disorder. Loss of appetite, diminished secretions, a torpid state of the bowels, irritability, lassitude, and extreme sensitiveness to the various changes in temperature, occasion a considerable degree of discomfort, whilst a gradual increase or exaggeration of the symptoms towards evening, restlessness during the night, without any refreshing sleep, and ill-timed lethargic drowsiness in early morning, represent the alternate conditions of nervous excitement and collapse, and the subsequent imperfect efforts of the system to establish healthy reaction. I pass on, however, now, to the

consideration of more advanced disorder, where exhaustion becomes, for want of proper reaction, a continued depressant of functional energy in the various organs of the body, and that which is weak becomes weaker still, from the stomach sharing in the general decline ; failing in digestive power, it ceases to provide a sufficiency of nutriment, upon the proper supply of which depends the whole activity of the animal machine.

Constitutional debility, not vigour, now characterizes the system, and comfort disturbed, the nature of the mischief naturally becomes an object of anxious inquiry. By many patients it is graphically described as consisting chiefly of a sensation as of great anxiety located in the stomach. In the day, a frequent lethargic heaviness or oppression in the brain ; at night, a restless wakefulness subverts the usual order of things. The tongue is unnaturally clean, and very tremulous around the edges and tip ; a constant nausea, or sometimes a very obstinate sickness, prevails ; and the most anomalous and ambiguous feelings are complained of in almost every part of the body. When attended with severe neuralgic pains it is also called "the sinkings," sufficiently attesting the popular idea of the nature of the attack ; and altogether the seat and symptoms of this very general complaint, besides indicating the importance of attending to diet, in the first place, forcibly impresses us by a negative kind of evidence, of the direct dependence of bodily comfort and general health upon the properly sustained functions of the stomach.*

The human system, invaded by a depressing influence (constituting in effect general nervous debility), to support its vital energies makes a demand upon the nutriment contained in the blood. If solely owing to mere over-

* Besides the symptoms enumerated, a host of others, each one sufficiently exaggerated to be presumed a first cause, disturbs all reflection and self-examination, especially as the mind of the patient, sharing in the general weakness, marshals up a corresponding array of fears and doubts. A calm, experienced observer, however, sees nothing in all these to discourage him in his attempts to cure, though, I may be allowed to observe, it offers a wide field of temptation to unprincipled practitioners, and a mine of wealth to advertising quacks. Ignorance, however, may perhaps afford some excuse for very many unnecessarily protracted cures ; and, on the other hand, sometimes constitutes a very untoward reason for many untimely deaths..

exertion, rest, and proper refreshment, will effectually remedy the evil, and probably after one effort of reaction. Should its origin be of a graver nature, such as the exhaustion which follows occasional excess, or casual error in diet, the previous healthy condition of the blood may still contain ample resources for a spontaneous and speedy cure. But in this latter case the operation will not be of the quiet and symptomless character exhibited in a good night's repose, correcting the consequence of some extraordinary exertion. Extreme thirst, loss of appetite, headache, probably sickness, and other disagreeable feelings, will prevail, strongly marking the efforts made by nature to readjust the disturbed balance, occasioned by a preternaturally excited circulation, first exalting nervous power above a healthy mean, to be afterwards depressed in a proportionate degree, when the unusual *stimulus* in the blood is exhausted or withdrawn.

A standard of constitutional strength is thus shown, not only to exist, but to be a necessary accompaniment of vital phenomena, imposed by the fluctuating nature of internal resources and external relations. From the same cause, this mean must be a constantly changing quantity, advancing or declining in vigorous development, as the circumstances of nutrition and situation are favorable or otherwise to the support of physical being. I have also every reason to suppose, that besides providing the necessary supply for the ordinary expenditure of nervous power, a daily adjustment of the *stimulus* contained in the blood to the standard of constitutional strength, just alluded to, is a most important part of a superintending economy which, during the repose of night, thus regulates, at the same time that it recruits, the ever varying re-agencies upon which life depends. Nor must this idea of economic adjustment between two vital forces be considered extravagant, nor yet even novel. The operation being upon the blood, and essentially of a conservative nature, I take it to be the first most tangible process in the passage of the immaterial to the material, where abstract vitality realizes itself in a physical form, as action submitting to a law which reason can perceive and calculate upon. We have an analogous exertion in the same vital fluid for similar conservative purposes, and regularly measured by a monthly term (as is the instance immediately under notice by a daily one) in menstruation; and in the fixed period imposed upon gestation, we have other evidence

of a principle involving the relative subjection of the body to measured revolutions of time in external nature.

This law of daily adjustment, between the *stimulus* contained in the blood, and the *organic sensibility* of individual systems, has an important bearing upon the preservation of health. Where the healthy mean is easily preserved, as in children aided by a powerful vital instinct, and in adults, where wise and prudent conduct leads naturally to a happy equilibrium in the demand and supply of the first element of life—nervous power—the pleasant experience is what is known as good health. The contrary, of course, is ill-health, but without other form, as a particular disease, than that which I am describing as *indigestion*. It is a general bad condition of the body, marked by disturbance, more or less, according to circumstances of varying constitutional strength, in the functions of the several organs, as deriving power from the brain or spinal marrow; and all its developments are primarily nervous. The vital law of adjustment continues to act, though weakened in effect. Its benignant operation is now no more than a palliating influence, that interposes daily fresh efforts of reaction, which, if not successful or sufficient in themselves to neutralize the vital depressant, and establish a cure, afford opportunity to be taken advantage of by reason and experience. And further, its endeavours to restore, although ineffectual, suggest the safest means, and the best times, for applying remedial measures, whether in domestic discipline, or medical practice.

Thus it may be observed, in the *indigestion* of Natal, that it is this process of adjustment which is first affected by a general loss of vital power, and not the particular functions of the stomach suspended, as might be supposed. The loss of appetite, for example, is more apparent than real, being chiefly interfered with by a convulsive heaving, allied to an effort of coughing, which throws off the stomach whatever food is taken—a phenomenon which is clearly indicative of nature's own remedy, for in this simple and direct way, by temporarily withholding a supply of fresh nutritious matter, the usual *stimulus* contained in the blood is lowered in degree, and an equilibrium for the time obtained between the muscular contractions of the heart, and the diminished power of reaction which is operating in the capillaries, thus adapting the circulation to the lowered tone of organic sensibility. The converse proves the same thing, for high

and luxuriant living on strong and stimulant food, when natural weakness of constitution, or even progressive age, is lowering organic energy, by exciting the heart to increased action, is only to add, as has been well remarked, an additional burden upon an already overworked system.*

A periodic adjustment of some relative condition between the frame and external nature, also seems to determine, in the animal kingdom, the yearly casting of the outer integument—as of the skin in the case of reptiles, of the hair in beasts, and of the feathers in birds. And it is remarked that the vital energies correspond with the season—vigorous during spring and summer, gradually declining in power as the winter months advance. An analogy extends to the like season phenomena in the vegetable world; and it is my opinion, that the nearer man's physical economy approaches to its original perfect condition, the more he shares in a universal operation, that it is not presumptuous to say has been instituted in a general law of life with a wise and benevolent purpose. But, “fallen from his high estate,” the original sensitiveness of the skin, evidently intended to be so watchful and warning of coming peril to health from without, has been in a great measure lost, though it is still the organ of all others to which medical science looks for greatest help, and directs all her means to excite favourably, with the best hopes of reducing or dispersing disease. These considerations have a further value, as they accord with the

* That loss of appetite, the first symptom of indigestion, is meant to be a kind of counterpoise in a too full habit, is clear, for where impatience and ample means, by the use of savory and tempting viands, allow of a certain triumph over this natural check upon excess and indulgence, the consequences are soon seen (at all events in Natal) in that palsied, yet frequently painful, affection of the nerves of nutrition, called gout, which marks an advanced stage of indigestion; or else, where the drunkard's, rather than the glutton's, taste prevails, in that closely allied form of *delirium tremens*, which affects intemperate constitutions. It is a remarkable fact, that where the vice of intoxication can be indulged without exposing the victim to the poverty and hardships usually associated with such a course of living, *delirium tremens* actually takes the form of what is known in England as the *gout* in the stomach. As I write, I have three distinct cases in my mind, where the occasional habit on the one hand, and the circumstances of affectionate nursing in the intervals of sobriety on the other, thus led to the modification in the ordinary form of *delirium tremens*, and confirmed me in my idea of the generic identity of the two disorders.

principles of natural consistency which requires, if there be but one radical law of mortal decline, it should be the same in animals and man.

And here is the proper place to remark upon a most interesting, but little considered, subject, connected with the prophylactic functions of the skin in its normal integrity. This is the striking alteration in its appearance and texture produced by situation and climate, and on which depends the differences in the white, or European; in the yellow, or Mongolian; and in the black, or Negro races. None of these can truly be said to be the representatives of the first parents of man. Particular relations existing between external nature and the human body, require, according to *habitat*, corresponding modifications in the character of the skin, to adapt its economic operations to widely different meteorological conditions. Thus the extremes of heat and cold, in dry elevated countries, require a provision for comfort which would be out of place in the humid atmosphere of low maritime countries, where dryness and moisture of the air are the conflicting alternations, sometimes great and sudden, against the shock of which the skin has to interpose some protection to the general system. In the vegetable kingdom there is an economy to subserve similar purposes, for in some situations—at the Cape of Good Hope, for instance,—we find thick membranous, or fleshy leaves, the the general character of the indigenous vegetation; whilst in others, as the desert plains of the elevated interior, the rootlets of most plants are provided with numerous glandular enlargements; and in both cases naturalists concede that a peculiarity of climate, or a contingency of situation, is met and compensated by the character of these extraordinary arrangements.

The skin of the inhabitants of the low countries of Holland is remarkably coarse and thick, and the same is observed in the fenny districts of England, which can only be ascribed to the humid nature of the atmosphere, constantly burdened with vapour from the Northern Ocean, determining a peculiar constitution of the skin; whilst, on the other hand, the thin transparent skin, and sanguine complexion of their Saxon brethren on the higher plains of Germany, as surely indicate the pure and dry air they enjoy. And it is only extending the illustration, and combining with it corresponding adaptations for the extremes of heat and cold, and sufficient margin will be given

within which to arrange, in a connected order, every variety of feature and form exhibited by the several nations of the earth. But with this general ethnological consideration I have nothing to do. My object is to direct attention to the chief cause and seat of that great and specific difference in the appearance of disease as developed in Natal, and such as I observed, and have been taught to know it, in England, and which is connected intimately with a meteorological condition general to the whole southern hemisphere, distinctly and, as I believe, exactly opposite to that which prevails in the climate of the northern half of the globe. I can almost imagine that the natural opposition of the two electric poles characterizes the two situations, and affects in a relative manner the human frame. At all events a grand natural feature specifically distinguishes the two situations. The atmosphere resting upon the vast Southern Ocean is constantly receiving accessions of vapour, as each crisis of saturation is resolved into rain or heavy dew by a law of daily condensation, depending principally, it would seem, upon the position of the sun, as being above or below the horizon. During the six summer months, from September to April, or the season of the south-east monsoon (of the violent character of which there is no parallel experience in the northern hemisphere), this continued succession of excessive moisture, and of as suddenly and complete a dryness of the air, is very strikingly apparent.* This of itself would almost suggest some necessary extraordinary provision to support the human system under the alternate extreme conditions of suppressed perspiration, which a moisture-saturated atmosphere imposes, and the correspondingly excited activity of the skin, when the excessive dryness of the air which follows a discharged thunder-storm gives opportunity for the oppressed circulation to relieve itself of a superfluous and obnoxious load of excrementitious fluid.

The effect upon the human system, with regard to temperature, is another important consideration connected with the comparative quantity of moisture contained in

* To some degree an analogy may be drawn in the relation of summer thunder clouds in England, to the heated atmosphere in which they are suspended; these volumes of aggerated vapour being separated into distinct strata by intervals, varying in extent, of very dry air.

the atmosphere, for, as has been well observed, it is not merely by thermometrical degrees that the influence of the weather on the human frame is to be estimated. In the northern half of the globe, where land predominates so excessively over water surface, even as four to one, the arrangement acts as a vast drying stove upon the air above; exactly contrary to the result that is produced in the south, where the air rests upon a body of water which, in comparison to the area of land exposed, is the very reverse of the former. Consequently we find, that whereas, in the temperate regions north of the equator, we have an atmosphere containing as the rule a *minimum* amount of moisture, on the contrary, in the corresponding region to the south, we have it burdened with the *maximum* which the natural law that limits saturation will allow. Now it is common experience that moist, humid air affects the body much more sensibly than at the very same temperature when dry. It has a more intensely penetrating effect, and disposes to a shivering feeling, and pale, collapsed appearance, very different to the sense of greater firmness in the muscular fibre (*tone*, as it is called), and the reactionary ruddiness in the skin excited by dry, bracing air. But there are, besides, other effects upon the human system, produced by different conditions of the atmosphere, too important to be overlooked. The moist, hot summers of Natal produce a universal feeling of languor and oppression, sometimes accompanied, in weakened frames, with exhausting perspiration, especially during the prevalence of a peculiar hot wind, the character and origin of which has long been an object of curious inquiry.* Diminished vital action is indicated by the general tendency to low

* This wind is the under and reversed current of the north-east trades, so genial and refreshing in their normal course, but becoming totally changed, not only in direction, but also in electric condition, whilst sweeping in irregular vortices from the westward, over land, the surface of which is favourable to the production of this phenomenon. Such are the confined, trough-like depressions which terminate the extensive terraces (and towards which all the drainage water tends) wherever an abrupt ascending ridge marks another upward step in the road over the Drakensberg. To prove this, a traveller on the long sloping plain, passing gradually into the influence of a hot, westerly wind, has only to proceed onwards to an elevation of one or two hundred feet, to find himself in a brisk, refreshing breeze from the eastward, which increases to a gale as he advances higher. This wind coming from the sea is

nervous fever, which is simply congestion in the capillaries of the skin. Miscarriages, or allied discharges of blood, are also a frequent consequence; and in fact I have been led to account for the extreme facility of parturition, and the impunity of young females from many of the diseases of their sex in South Africa, to the relaxing effect of excessive humidity, combined with a high temperature of the atmosphere. At the same time, the chills produced by the specific influence of moisture, combined with the colder airs of night, try to the utmost the constitutional strength of the inhabitants of Natal; not, in my opinion, with any ill effect, as the apparent evil is more than compensated for by an increased sensibility of the nervous system, as developed in the capillaries, for the special purpose, as it seems, of giving timely warning and alarm, for reason to make provision to meet the exigencies of weather. It is this which makes man, really the most exposed of animals, superior to all, and leads to the use of clothes, the first and most essential of medical comforts.

vapour-burdened for the far interior of the continent; but where its lower edge comes in contact with the Drakensberg, and is reflected back, its natural tendency is to condense and discharge its moisture in rain. In the summer months the heat of the midday sun suspends this operation, and the vapoury clouds are dispersed over the sky in the form of *cirrus*, or mares'-tails, as they are also called, indicative of the atmospheric vortices created by electric excitement, when the necessary conditions to determine condensation and discharge are absent. No sooner, however, does the sun begin to descend, and the temperature of the day declines, than patches of dense *cumuli* appear on the western horizon, which gradually accumulate and advance until they cover the whole sky. As evening approaches the cooled clouds are brought still nearer to the oppositely excited and heated earth, when a succession of electric discharges soon adjust the previously disturbed relations, and delightfully calm and genial nights thus regularly follow the hot, sultry, and oppressive days of summer. Under some circumstances, unfavourable to the operation of this meteorological law of daily adjustment, the hot west wind will blow for several days together, and, though charged with moisture, all vegetation withers, and vitality seems to droop. One observation must not be omitted, as connected with the highly excited electric and humid character of the atmosphere. Vaccination, during the summer months in Natal, can never be depended upon. It most generally fails, as if the *lymph* used had lost its power, and when it does succeed, the progress of the puny and unsatisfactory pustule is suspended, and we may have to wait a fortnight before it reaches maturity. This, in England, is usually attained in six or seven days.

Under these circumstances the meteorological contingencies to which the human frame is liable, are as different as the situations I have attempted briefly to describe. Fortunately, in the present state of knowledge, the most apparent are the most important as regards the preservation of health; for whilst, in the southern hemisphere, protection requires a watchful carefulness to guard against the continual relaxing tendency of a preponderance of moisture in the atmosphere; in the north, a bracing tonic operation seems the natural effect of light, dry air—which, however, is found to be accompanied with this mortal inconvenience, that the constant invigoration derived from circumstances, not in themselves nutritious, produces a nervous development which exceeds in energy the mechanical or textural constitution of the frame. Very trifling causes of disturbance, therefore, occasion such violent efforts of reaction in the system, that symptoms which nature actually intends for cure, become dangerous diseases, and, in the form of active inflammatory disorganization, is the scourge of the various populations exposed to the otherwise seemingly very favourable circumstances of situation.

In this manner (chiefly by modifications in the constitution of the skin) nature has produced two varieties of man, one in blood, but of very different vital, and mental, and moral characters; and my views connected with this curiosity of ethnological history, is well sustained by the experience of the past, and the closer experience of present time. From the universal descriptions of South African travellers, the disposition of the inhabitants of that continent, in their natural state, is mild, social, and possessing a peculiar aptness and desire for trading—an intercourse which presupposes a love of peace, a high sense of justice, and a capability for friendly relationships, which, enlightened and enjoyed, is the divine love of the Christian religion. On the contrary, all history bears witness to the military genius and commanding ambition which characterises the children of the North, delighting in the excitement of war, and the exercise of arbitrary power, which presumes the triumph of selfish aggrandisement at the expense of the lives, the property, and the happiness of others. To go further, however, into the subject of the mental developments which accompany the two different constitutions of man, promoted by geographical situation, would be foreign to my present purposes. It will be suffi-

cient finally to observe that, in my opinion, whilst the principle of self-will appears to be the grand moving impulse in the northern hemisphere—in the southern we see human nature, in a more amiable aspect, given up to a general feeling of non-reliance upon self. And this essential difference in moral constitution I attribute entirely to peculiar influences of external nature operating, in the first place, upon the physical economy, in some such manner as is well known, on the one side, to give a specific preponderance of vital effect to the *stimulus* contained in the blood, producing that complexion and temperament of body called *sanguine*; in contradistinction to a tendency of climate, on the other, unduly to excite and exhaust *organic sensibility*, and which, according to degree of combination with the *sanguine* character, constitutes the *bilious*, or resolute; the *lymphatic*, or indifferent; and, when in excess, creates the *nervous*, or irritable, temperaments.

These apparently discursive remarks have a practical value, as introducing an interesting observation with respect to the origin and real character of two very general, and truly constitutional, diseases. These are *scrofula* and *leprosy*—the very different forms which textural debility of the skin assumes, when vital forces, contending with adverse influences of climate, are strained to the utmost limit compatible with the support of life. The former, or *scrofula*, as a general proposition, seems to affect especially the northern; whilst *leprosy* prevails among the inhabitants of the southern parts of the globe. Without doubt, localities may be found where the alleged constitutional taint appears reversed, or conflicts with my pathological geography; but, like all exceptions, these cases, I feel assured, from observations made both in Europe and South Africa, will prove the rule, as their extraordinary appearance is only to be accounted for on the presumption that they co-exist with the accidental presence of the same meteorological influences, and exciting causes, I have just described as being so peculiarly characteristic of the two opposite hemispheres.

The explanation of this singular divergence in the appearance of the same diseased action in the system, will be found to be in the constitution of the skin, and the nature of its functions, as varied by the circumstances of situation. The principal contingency providence evidently contemplated, and made the necessary provision for, was

sudden changes in the amount of moisture in the atmosphere: for the grand difference in the physical development of man, thus distinguished, consists, in the one case, of a proportionate increase or development of the absorbents on the surface of the body, and in the other of a contrasting tendency to thin out the skin, at the expense of the same system of vessels.* Increased activity and constant excitement of the absorbents, arising from a continued meteorological influence telling on the skin, must tend to promote their development as a system, and endow them with a corresponding supply of nervous energy; and such a system, paralyzed in its operation by suspended vital powers, would exhibit very different characters of disease from the appearances of the skin, similarly affected, in a family of man long situated where an opposite condition of the atmosphere prevailed, and where, accordingly, the absorbents would be kept in a comparative state of inactivity. And when external influences are allowed to operate unchecked, whether under adverse circumstances of climate, or on bad conditioned frames, the deterioration in the physical constitution of man will proceed accordingly, taking the form of leprosy wherever a humid atmosphere prevails, and that of scrofula where a contrary condition exists.†

The remarkable improvement in many serious consump-

* A recent physiologist (Klein Grant, in his edition of Hooper's Medical Dictionary) remarks:—" If the proportion of the fluids to the solids is too great, this superabundance of the humours, which is constantly in favour of the lymphatic system, gives to the whole body considerable bulk, determined by the development and repletion of the cellular tissue. The flesh is soft; the countenance full; the hair fair; the pulse weak, slow, and soft; the form rounded, and without expression; all the vital actions more or less languid; the memory treacherous; the attention not continuos." The Professor's type is evidently derived from the white population of the Dutch Netherlands. Of course the experience of the swarthy inhabitants of South Africa exhibit very marked deviations from this description, but the main fact, of the increased development of the absorbent or lymphatic system, to compensate for excess of humidity, whether in the atmosphere, or in the juices of the system, is fully confirmed.

† It is interesting to note, that the ordinary naked condition of man in a savage state, is particularly calculated to promote that development of the absorbent system which gives thickness and softness to the skin, and is accompanied with a childish simplicity of character,—the very constitution of mind best adapted for the natural

tive cases, after a very short residence in Natal, and their ultimate complete recovery, could not fail to arrest the attention of both patients and medical men; and as the same observation extended to the benefit obtained by scrofulous constitutions generally, it became early with me an interesting study to account for and explain. A contrasting disposition in another class of individuals, newly arrived in the colony, to develope a succession of numerous circumscribed and very painful suppurative tumours in the skin, for several months before the habit was corrected and disappeared, naturally associated itself with the previous consideration; and the varying phenomena of these two very different characters of acclimatation, combined to direct my attention particularly to the mucus membranes of the body, as being the obvious seat in both cases of the transition process. Further information came with the decided evidence of a specific tendency in the climate of Natal to develope, in particular constitutions, frequent attacks of that painful disorder of the nerves, chiefly of the skin, called *tic doloreaux*, and which, I very soon found, was an extraordinary effect of the first great cause of all nervous disturbance, *imperfect nutrition*; taking this form in ordinary cases of indigestion, where otherwise, as when the consequence of dissipated habits, *delirium tremens* would have been produced.

In considering again the particular character of leprosy (many cases of which I had the opportunity of examining at the leper establishment, Robbin Island, in Table Bay), I saw that it could only be referred to organic disease having invaded the texture of the skin; and from the ultimate sloughing away, in the worst cases, of the joints of the hands and feet, I inferred that obstructed capillary circulation locally, and deficient power in the vascular system generally (the greatest aggravation in the symptoms appearing in parts most remote from its centre—the heart), were the present causes of this loathsome complaint. The fact also of its being confined to the badly fed, and worst cared for of the population of the Cape, as the rule, and

exercise of humanizing influences, or for the organizing operation of enlightened mind, when the proper time for the work has come. A thick skin is certainly a provision for peace, and the application of the term of thin-skinned to quarrelsome tempers, thus receives curious illustration of its aptness and truth.

only appearing among the higher classes as exceptional, and to be attributed then to bad habits or contaminated blood; circumstances of condition and character very analogous to those which mark the presumed origin of scrofula—imperfect nutrition—betraying itself in imperfect organization of the skin. As in the latter disease, sufficient and good food is also found to be its most natural corrective; and another analogy of pathological unity has been observed, that considerable relief is afforded for a time in leprosy, by the spontaneous removal of the more distant extremities, as if the nutritive powers had then become equal to the support of the remainder of the body, corresponding with the remarkable good condition which patients soon exhibit, where scrofulous white swelling, or similar disease of a joint, has led to the removal of a limb.

In Natal we have a very suspiciously characterized disease suggestive of leprosy, and sufficiently frequent to attract the attention of an English medical man as being peculiar and novel, though in looking up the subject he may find here and there reported cases of a similar kind in the hospitals at home. Such is the felon boil attacking the last joint of the thumbs or fingers, and a great tendency in many persons to a painful ulceration of the soft parts surrounding the toe-nail. It is usual to confound these cases with ordinary whitlow, and many a mutilated stump, after months of torturing cure, have I seen as the result of the treatment pursued. Experience has taught me that the real cause is to be looked for in some depressing influence telling upon constitutional strength, which reduces functional power in the capillary extremities of the system; and in such cases I have good reason to consider the most serious one to be the too free use of animal food, under circumstances of mental excitement from some moral cause, as grief, reverse of fortune, or any great disappointment. My practise, therefore, is, to prescribe a strictly vegetable, but generous diet, with alterative doses of calomel, combined with morphia, applying, at the same time, to the suppurating joint, a stimulant plaster of sugar and soap, or a soothing one of Belladonna extract, in fresh cases, and of citron (nitrate of mercury) ointment in old ones. A change soon takes place in all the circumstances of the case; the white tongue, the jerking pulse, and restless nights, disappear, and very little difficulty is experienced in effecting a cure. In no case is it necessary to use the knife (unless,

indeed, application for advice has come so late that there is no alternative but to remove some diseased portion), either to cut down to a presumed abscess in the sheath of a tendon, or to reduce or remove a nail. In instances seeming to require this latter course, the gradual introduction of a thin layer of cotton wool (to be changed every day) between the insertion of the nail and the surrounding soft parts, proves a speedy and effectual means of relief.

Altogether, viewing the subject in its various aspects, I feel assured that the seat of the beneficial operation of the climate of Natal in scrofula, and of the opposite one, indicating a tendency, under particular circumstances, to develope leprosy, is in the skin, and the allied membranes of the body. For instance, it was easy to explain the benefit derived in consumption, as being due to the relaxing effort of a humid atmosphere upon the delicate reticulation of minute vessels constituting the mucus lining of the air-cells and tubes of the lungs, assisted, of course, by a decrease in the natural stimulant of the blood, oxygen, where the volume of air inspired contains a certain proportion of watery vapor. Again, the evident conservative operation in *catarrhal influenza*, consisting of a critical discharge from the lining membrane of the stomach and bowels, testified the same thing, of the vital activity constantly exerted for the preservation of the health, in the peculiarly extended organism which envelopes the human frame, both externally and internally. Lastly, an argument to the same effect, but certainly of a negative character, is to be drawn from the violent disturbance occasioned in the general system by suppressed perspiration, or any other cause which leads to congestion in the capillary circulation of the skin.

With such indications of the activity displayed in the skin, either to repel the assaults of any depressing influence, or to correct the effects when produced on the human system, it is a natural consequence that time, and frequent occasion, should tend to modify texture, and occasion considerable changes in the appearance of an organ so extensively exposed, and subject to such constant excitement, as the compensating medium between a delicate internal economy, and accidents of external origin. It also follows that, as in the most vigorous, a happy facility of adaptment to circumstances of situation, is a correct index of constitutional strength, and the earnest of a healthy progeny, so.

in the more degenerate of the race, the opposite condition, or a morbid sensibility, seems frequently to become a natural habit of body, and is well known to be transmitted hereditarily to their offspring. Thus it is, in a general view, that the special contingencies of climate I have before described tend to produce characteristic evidences of their specific influence, wherever the resources of life are below a certain standard, and unequal to resist continuously their adverse operation upon the human system. The contrasting appearances of the skin in *scrofula* and *leprosy*, serve to illustrate this observation, for although in both cases proceeding from insufficient nourishment, resulting in defective organization, each is the peculiar development accompanying opposite, or at least different, conditions of the atmosphere, and are like two experiments testifying to the same thing, namely, the important function of the skin to counterpoise and check sudden or extraordinary relations between animate and inanimate nature. And more especially is this seen in the evident relief which a mutual change of climate produces in affected constitutions. In this way only can we account for the exemption from *scrofula*, and all acute inflammatory disease in Natal; whilst, on the other hand, the remarkable ignorance of European medical writers, until within the last twenty-five years, of the real nature and proper character of *leprosy*, is a circumstantial piece of evidence I take advantage of to presume its very limited appearance in the northern hemisphere.

To enter further into the particular character of these certainly allied diseases is unnecessary, and would be too digressive for my present purpose. That they are due to extraordinary circumstances affecting capillary economy is clear, from their evident connection with the extremities of the circulation, especially in the skin, and in the small lymphatic (absorbent) glands on its under surface, or else in analogous situations internally, affecting the mucus lining and glands of the air-tubes and cells in the lungs, or of the corresponding membrane of the alimentary canal. Nor must I omit to draw attention to the fact, that in healthy persons these are the very situations where, by a constitutional law, to be enlarged on hereafter, the evidences of temporary disturbance in the system chiefly appear, and are also the seats of the reactionary operations of the *vis medicatrix naturæ* in effecting spontaneous relief.

Lastly, it is interesting, as being in exact accordance with principles before laid down, and corroborative of the pathological unity in the origin or cause of these contrasting developments of disordered action, to note the different mental conditions of persons affected by these allied, and yet contrasting, diseases. The dull, stupid idiotcy, so characteristic of the leper, especially as age advances, is, in the scrofulous, represented by preternatural vigour, and brightness of intellect, with a great tendency to maniacal excitement, frequently disposing to suicide. It is also singular to note further, that whilst, on the one hand, the ugliest and most hideous of the race are characteristic of the leprous constitution, on the other it is notorious that the fairest and most beautiful are found among the victims of its strangely contrasting prototype of the northern hemisphere.*

It is necessary to keep these circumstances connected with the pathological unity of *scrofula* and *leprosy* in the mind, if it is intended to realize an idea only half caught, that the nervous indigestion we have so good an opportunity of observing in Natal, is the first indication of insufficient vital power to meet circumstances of situation, and which correspondingly affects the constant natural effort in the system to preserve the balance of power between the various reactionary influences operating in the human frame. Endurance of exertion seems the best measure of constitutional strength, and, primarily, of the organs immediately connected with the conversion of food into nutriment. Hence first symptoms of decline appear in disordered functions of the stomach; then a sense of discomfort and lassitude enforces a husbanding of nervous resources, whilst instinct and reason are employed in providing for, or guarding against, the evil affecting health. If these fail in their object, nature has no other resource than to diminish nervous expenditure in the capillaries of the skin, to concentrate for organic purposes within. So far a sufficient vital energy is preserved to complete daily a regular adjustment

* The extraordinary relation in the travels of Sir John Maundeville (1366), of a country where there were "folk that han but one foot, and thei gou so fast that it is quite marvaylle, and the foot is so large that it shadeweth alle the body agen the sonne whaune thei wole lye and reste hem," seems to have arisen from exaggerated statements he had received of the prevalence of leprosy in Ethiopia, and South Africa generally.

of the relative forces exerted by the nervous and sanguinous systems, although individual peculiarities may require very considerable differences as regards length of time for repose, or careful selection of food to compensate for the original weakness of indigestion, or unusual exposure to external accidents of nature. In this manner health may be sustained for a life time, but always at a point of easy subversion, whilst climatic or dietary circumstances are favorable, although the constitution is weak, and the prophylactic susceptibility of the skin almost lost. Finally, a leprous or scrofulous disposed progeny tells of a degenerated race, when the natural characteristics of constitutional debility become exaggerated by continuous exposure, for generations, to the further malign influences of vice, folly, and ignorance. When so much depends, therefore, upon the systematic adjustment daily effected in healthy systems, between the relative forces of *organic sensibility*, and the *stimulus* contained in the blood, something more must be said on the economy provided to sustain it. Next to nutrition, this is the most important instinct active in the physical economy of man; and to effect its operation, the skin, and mucus membranes generally, exert a common function, as specific, and as specially provided for with an adequate nervous machinery, as is the stomach and alimentary canal for the purposes of digestion. For this purpose the texture and constitution of this extensive organism (which invests the body internally and externally with one continuous enveloping membrane) appears to consist of a uniform network of minute vessels, subdivided to an infinite degree of delicacy. By the perspiratory and absorbent systems so largely developed in the skin, the blood contained in the capillary vessels has direct communication with external nature; according to circumstances, relieving the circulation of a proportion of aqueous humor, or on the other hand, when necessary, imbibing it from the surrounding atmosphere. There is also a transpiratory process continually going on in the skin, more especially active during the repose of night, which effects a gaseous change in the constitution of the blood, as considerable, and as important, in an economic point of view, as that which takes place during respiration in the lungs.

Following up these remarks, I now come to the consideration of the direct control nature possesses over capillary action arresting or accelerating the circulation according to

circumstances, and proving as extensive a ramification of minute sensitive *fibrillæ* in the skin, as of arteries and veins in its vascular constitution. The point of the finest needle cannot be introduced into any part of the surface of the body, without wounding a blood vessel or injuring a nerve. As a general proposition, capillary action may be said to be altogether nervous. Hence the blanching or blushing of the cheeks from strong feeling or passion ; hence the chill of fear, and the heat of anger, experienced in the skin—considerations which lead us almost to conviction, that the corresponding but exaggerated developments of disordered action (especially observed in the cold and hot stages of febrile progress) are due to some abnormal interruption in the functions of this sensitive and widely extended organism, which includes, not only the external skin, and the lining membrane of alimentary canal, but also constitutes the most important part of every absorbing or secreting organ ; being the very seat or sphere of that conscious control which selects or rejects, whatever the particular purpose of the several viscera of the body requires, thus to be taken from the blood in its passage through them. Whence, or what, this conscious control, is no question here. That a resident intelligence directs the physical economy of man must not be denied, and that its operations may be disturbed by adverse circumstances of external nature, is very evident in disease. Nor would it be difficult to prove further, that as the presence of the body depends entirely upon nutrition derived from the blood, and segregated into form by capillary action, whatever assaults the integrity of vital being, and predicates dissolution, must proceed by a diminution, and end in a negation of nervous power in these terminal minute extremities of the circulation.

Having said so much regarding the nervous control of the circulation in the skin, it remains to be observed that nature possesses another powerful means of influencing capillary action, by affecting the constitution of the blood through the medium of the stomach. I have already shown how loss of appetite reduces the *stimulus* of the vital fluid to a lowered tone of organic sensibility ; and there can be little doubt that the nourishing support, and sense of general refreshment, derived from food and rest, is chiefly completed by an increased excitement of nervous energy communicated to the terminal extremities of

the system. The readiness of assimilation, or the reduction of food taken to the purposes of life, constitutes the basis of a classification of nutriment, the first grand division of which is into *heat-giving* and *tissue-forming* aliment. Under influences of nervous depression, it is to the former which both instinct and knowledge have resort to relieve temporary exigency, and in the phenomena connected with the administration of stimulant medicine, and the popular use for the same purpose of spirituous fluids, will be found the best illustration for my present object, to show the means in possession of a supreme authority, active in vital economy, to regulate and order two distinctly disclosed but subservient agencies, *organic sensibility*, and the *stimulus* contained in the blood.

So often having drawn attention to two contrasting elements in supporting health—or else active in disease—to reduce these influences and their operations to common understanding, it is necessary, in as few words as possible, to connect them still further with vital forces in the abstract. In the first place, then, it would seem as if life, or active being, is sustained by the delicate susceptibility of an incorporeal, yet an embodying sensitiveness, to *stimuli* derived from external nature. The operation upon each other of these antagonistic, yet evidently reactionary, principles, gives to matter a new existence, and takes it out of the world of ordinary chemical and mechanical laws. The result is seen in the material forms *vitality* (to give the mysterious first cause a name) assumes, and which is known to human reason as animal existence. And secondly, all I have to say here is, that the nervous sensibility of the capillaries, and the stimulus in the blood, alternately predominating with equal power in the system, exhibit, in a practical and convenient form for illustration, all the phenomena required to realize this theory of life; and I may safely add, that beyond these two principles of vital motion, the mere fabric of the frame constitutes but the stage, the laboratory, or the vehicle, as the occasion or the purposes require, in connection with the general economy of material being.*

* Dr. Alison, in his *Outlines of Physiology and Pathology*, has an observation which affords me apt illustration here, that on this point my views are in accordance with received professional doctrine. He says:—In all warm-blooded animals the circulating

The *nervous indigestion* of Natal may further be said to represent a condition of constitutional irritability which always appears wherever the nutritive supplies or resources fail; by the former signifying a positive want of proper constituent material in the food, and by the latter, a loss of functional power in the digestive organs to extract from food the necessary *essentia* of life. The result upon the frame is the same—diminished vital action in the capillaries—evinced according to circumstances of exposure or constitution, in degrees of nervous debility, from *indigestion* to palsy, on the one hand, or else, as vascular irritability, from congestion, to the worst kinds of fever, on the other. According to my view also, situation determines the prevalent diseases of a country, into forms depending upon a specific tendency to either a typhoid or an inflammatory type, and which is intended, I believe, to be broadly asserted by nature herself in the peculiar phenomena connected with the development of *leprosy* and *scrofula*.

As further illustration of the simple and natural system of pathology, circumstances in Natal are so favorable to inculcate and prove, I shall take advantage of some contrasting points that arise in the course of *hectic fever*, as known in Europe, and in the peculiar *nervous indigestion* I am here attempting to describe. As an idiopathic or original disease in the constitution, I find the former described by Mr. S. Cooper, in his Surgical Dictionary, as “a slow mode of dissolution: the general symptoms are those of a low, slow fever, attended with weakness; for upon the removal of the hectic cause, the action of strength is immediately produced, and every natural function is re-established, however much it may have been previously impaired. The particular symptoms are debility, a small quick and sharp pulse, the blood forsakes the skin, loss of appetite, fre-

system is to be regarded as merely the channel of communication between the *capillaries* of the lungs—where the blood is prepared by the action of the air for the maintenance of the different functions of life—and the *capillaries* of the rest of the body—where it is applied to the support of these different functions. The collection and concentration of the blood at the heart, are manifestly intended to subject it to the action of a strong muscle, and thereby secure its transmission, with adequate force and precision, through the different sets of capillary vessels; and the juxta-position of the two portions of the heart which move the blood to and from the lungs, appears to be a mere matter of convenience.”

quently a rejection of all aliment from the stomach, wasting, a great readiness to be thrown into sweats, spontaneous perspirations when the patient is in bed, pale colored and very copious urine, and often a constitutional purging."

This condition, which in Europe is inseparably connected with extreme prostration of vital power, and usually distinguishes the last stage of serious internal disease, accompanied with suppurative disorganization, is, in Natal, the ordinary premonitory phenomenon in a system, threatened, but perhaps very remotely, with natural dissolution from deficient nutrition. For example, in child-bearing women, where the digestive organs are deficient in functional energy, and unable to support two systems, these symptoms, described as hectic fever, will every one of them be present; and also in a delicate mother, with a strong, healthy child at the breast, the very same general disturbance will soon make its appearance.* Then, again, those individuals whose constitutional strength is affected by *indigestion*, represented by a low, irritable habit of body, and whose efforts of daily adjustment in the system are accordingly most imperfect, require a very trifling exciting cause, merely perhaps some temporary depressant, to bring on an attack characterized by exactly the same symptoms described as constituting hectic fever; differing only in degree, as of course appearing in comparatively stronger frames. All these cases, however, may be known by giving way immediately to one calomel and jalap power, and a few days' dietary discipline, avoiding all animal foods, and substituting cordial gruels, in every basin of which should be one or two table-spoonsful of spirit. And it should be known the powder is not simply to relax the bowels, as is generally supposed, but to get rid of a considerable slimy discharge from the surface of the alimentary canal, and which, in my opinion, is the original cause of all the mischief of constitutional derange-

* Practitioners in Natal can well understand the reprieve of Dr. Smethurst, in the late presumed murder case at Richmond, England, for it is seldom, in an extensive practise, to be without instances of a low, continued fever of nervous irritation, arising from defective nutrition, during pregnancy. Obstinate vomiting, and constant diarrhoea, sometimes places the patient in a most critical situation. Every resource of medicine seems unavailing, except a cordial farinaceous diet, and complete rest. I have seen cases where the only chance of saving the mother was to bring on premature labour.

ment. One great proof is, that in the female system this chief source of the hectic disposition is removed from the bowels to the mucus membrane lining the womb. Wherever a leucorrhœal discharge exists, the same tendency to a term of daily nervous agitation, with increased excitement towards evening, betrays powers of life only just equal to sustain the necessary equilibrium of health; always on the verge of sudden subversion from the slightest invading cause. Such related constitutions supply the victims of every epidemic influenza, and the apparently capricious selection is in fact a useful strategical operation of nature, to separate the unhealthy from the sound, and, by a mild caution, advise otherwise ignorant man to pay due attention to support that functional power of resistance in the system, which guards against the passing exigencies of a variable climate. And this, let it be understood, is only to be done by proper care in the selection of food, as the loss of the guardian instinct is to be entirely attributed to neglect or defect in supplying proper nutriment to the ever-wasting body. It would seem that any excess of vital energy derived from the products of digestion, constitutes a reserve fund to enable the system to meet adverse circumstances of situation, without being constantly exposed to sudden prostration and discomfort; the great function, however, of this benevolent provision being to regulate, during the repose of night, the disposal of nutritive supplies, and adjust to a happy harmony the relative forces of *organic sensibility*, and the *stimulus* contained in the blood.

The phenomena accompanying an attack, as observed in England, and compared with that form of the disease which is alone met with in Natal, suggest some very corroborative reflections, that the *hectic fever* of European experience is the analogue of *nervous indigestion* in South Africa; both being the same low fever of nervous irritation, indicative of a decline of vital power, from insufficient or imperfect nutrition, the latter occurring, when the disorganization of tissue, as in *consumption*, interrupts the necessary changes in converting the digested products of food to the building purposes of the body.* *Hectic fever* and *nervous irri-*

* Let it be remembered, as an aid to proper conclusions upon the subject, that a striking characteristic of scrofulous and consumptive patients (to compensate, perhaps, for the constitutional evil), is that the digestive organs are seldom deranged, strongly

tability seem also allied, inasmuch as that a disposition to a painful exaggeration of nervous sensibility, marks certain constitutions that are favorable to the development of either peculiar type of vital decline. I consider *gout* to be this connecting link, although its excessively painful, circumscribed attacks in the extremities of the hands and feet is unknown in Natal. There, the nearest approach to it in character, is when *tic doloreaux* of the face is accompanied by excessive pain, heat, and swelling. The accession at night, daily exacerbations and decline of a low nervous fever, are all characteristic of gout, though, occurring according to European experience, in such an extraordinary seat. That which confirms the identity of the two attacks, is the liability in Natal of patients, subject to *tic doloreaux*, being at times much more seriously affected by excruciating pains in some one of the internal organs, accompanied with all the symptoms of what is termed retrocedent, or flying gout. A hot, burning skin, sudden chills, with a full, rapid pulse, white furred tongue, great nervous excitement, and excessive irritability of the stomach, prostrates the patient with alarming effect. Experience, however, has taught me that all this is delusive in real effect, and I often smile, and think how little is required to relieve the most threatening illness of the kind. One calomel and jalap powder is quite sufficient, and a few days' strict adherence to slightly stimulant farinaceous food, with a diet drink of rice-water, flavoured with an unpeeled lemon sliced, and sweetened according to taste, will soon satisfy the patient that, after all, health in Natal is the very easily acquired return of careful selection and thought in the choice of food.

Of course the widely different times of the approach in two systems, of *hectic fever* in one case, and *nervous irritability*, in another, creates a difficulty in recognizing their identity; but this is to be attributed to the original cause of the constitutional differences in the physical economy of the human frame, which I have previously endeavoured to show exists between the inhabitants of a climate cold and dry, and those living under the opposite influences of heat and humidity. Extending this observation to disease gene-

contrasting with the stomach origin of all hypochondriacal affections; a circumstance which reminds us, at the same time, that the nervous disposition of the two differently constituted habits notoriously differ.

rally, the extensive disorganization of tissue induced by inflammatory action, and the comparatively little alteration in *post mortem* appearances of organs, where death has ensued from nervous exhaustion, is another contrasting anomaly that disturbs opinion in reconciling the phenomena of all disease to one original and radical cause, and will expose the position I have taken to many attacks, on the ground of apparent inconsistency between moving cause, and the effect produced. This cannot be helped; but to diminish confidence in those who may question the conclusions I have arrived at, and lead to further reflective consideration, I have purposely brought prominently forward the remarkable pathological parallels to be drawn between *scrofula* and *leprosy*, as being, in a general sense, peculiar to the northern and southern hemispheres respectively; and also between *hectic fever* attending upon low inflammatory action in Europe, and the *nervous indigestion* of Natal, which ushers in the palsy of defective nutrition, from *hypochondriasis* to *delirium tremens*, or *serous apoplexy*—a more extensive and sudden operation of the same effusion upon the nervous system, to which I believe *delirium tremens*, more especially in its last stage, is to be attributed. For the same reason, not to be misunderstood, if possible, I have also given prominence to the reactionary forces of *organic sensibility*, and the *stimulus* of the blood, fixing attention more particularly upon the sphere of their greatest and most important operation in the capillaries of the mucus membranes, and in the texture of the various organs of the body. And as, according to my view, the radical cause of all disease is defective nutrition, the consequent loss of vital power will naturally first affect the supply of nervous energy in these terminal extremities of the circulation; but the symptoms of which, it seems, in appearance and character, are subject to extraordinary modifications, by the effect of climate upon the human frame, and which ultimately prove the source of special characteristics in the race, from the meteorological and hydrographical relations to which the inhabitants of a country are exposed by geographical situation.

Lastly, it is worthy of remark, that a mutual change of *habitat* corrects the specific predisposition to either of the respective diseases, and so far, of course, in a medical sense, is beneficial to affected individuals. Yet strange as it may appear, this points to no abnormal origin of these

disordered conditions, but proves that they are both the natural consequences of a law of adaptation, active in the physical economy of man, and endeavoring to adjust, but with insufficient means, the vital powers of individuals to ordinary circumstances of external nature. Unequal, however, to the special contingencies of one hemisphere, a removal to the other seems at once to adjust means to necessities. A healthy condition is now substituted for an unhealthy one, by an operation of the very same law that had previously oppressed the system, whilst a presumed defective organization in one situation is found to be the most suitable for another; anomalies which may all be explained by assuming, that whilst, every where, *organic sensibility* is a fixed quantity, determined by individual powers of nutrition, the *stimulus* of the blood, on the contrary, varies, and depends for effect more upon general causes; under one set of meteorological circumstances, exerting an undue preponderance in the capillaries, and under another, being subjected to a reverse phenomenon of diminished influence. Any oppression in the system, arising from either condition, is, however, due to imperfect adjustment between the two vital principles, a fault of individual economy, that can be traced to insufficient nourishment, leading to a failure in the supply of nervous energy, a defect which betrays itself on the slightest exciting cause in a variety of forms, and is, indeed, the common source of all disease, whether developed in an active inflammatory type, the predisposition of a scrofulous constitution, or as a low irritable fever of nervous exhaustion, the characteristic of a leprous disposed habit.

This review of the general nature of *indigestion* in Natal, and which, in a few words, may be said to constitute the difference between a good and a bad constitution, may serve as an introduction to some observations upon its particular character and treatment, especially as, in adult life, it is in an hectic form, sometimes as suddenly general as the catarrhal influenza of childhood. The latter is, in fact, this very nervous disorder, excited by some depressing cause, but occurring in systems strong enough in vital resources to repel any enduring influence. A determination of blood to the skin, and mucus membrane of the bowels, attended with a critical discharge, marks the process of cure, and which is found to be greatly assisted in elder children, by careful attention to a proper

and suitable diet; whilst, as I hold it to be, perfectly unnatural for children to die in Natal, the appearance of disease at all, in infants at the breast, is conclusive evidence of the bad condition of the mother, and no improvement will ever take place until means have been instituted to correct the evil or error on her part, which is affecting the wholesome character of the milk—valuable hints to direct us in the treatment of the same kind of attacks, when operating upon systems less fortunately constituted to resist the invasion.*

Three propositions, useful here to consider, will strike the intelligent mind as natural deductions from the observations previously made. They constitute the practical part of my study of medicine, and will be found to comprise all the main principles which should direct the treatment of disease in this colony. Of their constant faithfulness to the trust reposed in them, I can confidently assert that, as regards the characteristic disorder produced by our climate and situation, *nervous indigestion* (the radical type of every disease to which we are subjected in Natal), it is placed completely under human control by attention to their dictates; so much so, indeed, that in its most threatening form—low nervous fever—beyond the first stage I never see it now, save where ignorance or neglect have led to the extension and exaggeration of its symptoms before assistance has been sought. There must be something worth considering, therefore, in the nature of these three propositions, when success can challenge such a test as this.

The first is, that the complete consummation of the *vis medicatrix naturæ* in spontaneous cure, requires a perfectly sound constitution, and the nearer we approach this grand desideratum, the better able is the body to throw off any morbid impressions adverse circumstances of external nature would otherwise impose. Infant life, where the preservation of the individual is specially pro-

* In addition to the above remarks, I may also observe, that among young children at the breast, when they should not be—or, on the other hand, when they have been—deprived of this natural source of nourishment, and are being brought up by hand, may be expected the most serious cases of that catarrhal defluxion in the alimentary canal, which follows the attacks of epidemic influenza in Natal, and getting rid of which constitutes the greatest difficulty in its cure.

vided for, exhibits this happy impunity from disease (exception applying, of course, to ignorant and careless nursing), which is chiefly to be attributed to the perfect character of the nutriment supplied by the mother. Milk is food provided by a care more than human, and if the parent be healthy, and her diet good, life, in its normal excellence, has its best representative and type in a child at the breast. This is the converse position to that which refers the common origin of all disease, otherwise its unity, to defective nutrition. It is evidence, too, of a natural responsibility in the human system to protect itself against external accidents of climate and situation, by corresponding care in the selection of food, and proves, by the reactionary enjoyment of good health in consequence, the reality of the *vis medicatrix naturæ* so often mentioned. These considerations I assume to be undeniable, and to have the weight of facts. They reflect accordingly the great importance of careful attention to diet, as the first law of remedies, as it fortunately is the most available of all our resources on the first approach of ill health. In Natal especially, where we are relieved from all fear of active inflammatory action (the untoward conversion of reactionary relief into disorganization of tissue), and where urgency rather proceeds from insufficient restorative powers, proper food constitutes the best *materia medica*, or source of remedies. And extending the utility of experience to anticipate evil, rather than to meet its results, I can certainly recommend careful attention to diet as being all sufficient, if in adult life we would protect the constitution from too easily succumbing before some adverse influence telling from without.

Sufficient nourishment; for example, is here indicated as the first great remedy, and accordingly it will be found, that in every stage of indigestion medical advice will be most wisely restricted to proper instructions with regard to diet. And yet it is in this respect that mistakes are most frequently made by over-anxious friends, and too zealous nurses. Because animal food is the generally presumed readiest source of animal vigour, confirmed by an experience acquired in the northern hemisphere, where *scrofula* so extensively prevails, it is difficult, indeed, to convince people that, next to ardent spirits, it is a source of mischief most to be feared in Natal, where the scrofulous habit is immediately extinguished and lost. This is well

observed in convalescent cases, after the symptoms of ordinary remittent fever have subsided, but before constitutional strength has altogether returned ; and also after the exhausting efforts of protracted parturition. A basin of beef tea, or an egg, I have known under such circumstances to excite the most serious symptoms of nervous irritability ; and what is commonly (but I think with a very erroneous signification) called relapses, are almost always owing to some grave error or oversight in the matter of diet.

At all events, in *indigestion*, animal food precludes all chance of recovery ; and I can conceive that nature has no other way to arrest the evil, when persisted in, and stay the downward progress to some form of nervous palsy, than on the first opportunity of a depressing epidemic, to expose the already debilitated system to the (in such cases) correcting ordeal of remittent fever, when appetite, suspended altogether, and more assiduous care on the part of friends and advisers imposed, leads to salutary restriction, and the use of light farinaceous food. However, experiment is the best way to enforce this doctrine in Natal, where occasion is frequent enough, from the tendency of the climate to aggravate the slightest nervous disorder into some outward and visible expression. Let any one, therefore, who doubts my experience, try the effect of beef tea when labouring under sundry unusual and disagreeable feelings, the most prominent of which will be an unnaturally clean and white tongue, heavy lethargic oppression in the brain, and general disinclination for the least exertion. The chances are, that it will aggravate the symptoms into headache, sickness, and a regular bilious attack ; whilst, on the other hand, had food, for one day, been confined to light farinaceous drinks, and at night a medical comfort, in the shape of a glass of warm brandy and water, well sweetened, it would have aided most advantageously the natural efforts of the system to rally from whatever temporary depression it was labouring under.

The most striking illustration of the inappropriateness of animal food, after undue expenditure of nervous power, is seen in women after parturition, especially if accompanied with much loss of blood. This invariably leaves the patient in a highly irritable state for several days ; and indeed the question of peurperal, or child-bed, fever

arising, depends altogether upon the character of the food given during that time. Since my attention was particularly attracted to this important circumstance, I have not (although my practise is considerable) had a single case, and have satisfied myself that the charge of a tendency to this disease, unfairly attached to the climate of Natal, lies more properly at the door of inexperience and ignorance. I often detect (and can now afford to smile at the innocent surprise sometimes expressed when the error is pointed out) officious zeal on the part of nurses ; for, with the view of speedily correcting the prostration consequent upon extraordinary exertion, mutton broth, or even eggs, are not unfrequently given, and the effect upon the patient is to produce very serious symptoms of violent pains, such as throbbing fulness of the head, a flushed countenance, a pulse of 120, or even more, and sometimes a state of hysterical excitement, scarcely distinguishable from a mild form of *delirium tremens*. Error No. 2 generally is, that the medical man, impressed with his responsibility, and attaching too much importance to the apparently very threatening symptoms, depends more on what he has been taught to do in such cases in England, rather than what experience proves to be suitable in Natal. His endeavours are immediately directed to subdue the inflammatory disease which seems unquestionably present. Purgatives, saline draughts, and a careful antiplogistic diet of thin dilutent drinks, are persisted in, and the consequence is, that a dangerous, but perfectly unnecessary, illness is inflicted upon the patient, as the treatment leads to the very evil it is intended to obviate. All that is really necessary, however, is, first of all, to tell the attendants the real cause of the mischief, that it may not be repeated. One or two calomel and jalap powders (iv. and xii.), repeated, if necessary, every twelve hours, will soon bring away the offending matter ; and if, during this period of operation, diet be restricted to sweet cordial gruel (I am never afraid of adding a tablespoonful or two of good brandy or gin), and the medical man refuse to be imposed upon by the delusive symptoms, to which not only the patient, but even the nurses, will sometimes attach an exaggerated but dangerous importance, no serious consequences need be anticipated or feared, and recovery will take place within the ordinary term of confinement.

It has often occurred to me, when considering the

subject of fasts as religious observances, that the system must have arisen among a people living in a country and climate not very dissimilar to Natal. Their original reasonable use interests, whilst their subsequent superstitious abuse concerns, a mind that can divine the purpose of their institution. Suppose a numerous and barbarous population submitting to the rule of an intelligent and honest priesthood, really desirous of promoting the happiness of the greater number of the uninitiated herd committed to their charge. Observers of times and seasons, these shepherds, not hunters, of men, would soon acquire a knowledge of many important meteorological facts, and learn the value of numerous relations existing between man and external nature. Generalizing upon the frequent occurrence of epidemic complaints with particular conditions of the atmosphere, the succession constantly observed would almost force the conclusion of cause and effect, and would especially interest their attention, when it was found that care, and proper precautions, would arrest much of the malignancy of unhealthy weather. Surrounded, too, by many other loudly speaking circumstances, it would require no very great sagacity, nor an extensive knowledge of natural philosophy, to form sound opinions upon many curious operations in nature's economy, animate or inanimate. Where, for example, the attacks of disease took no especial character from circumstances of individual constitution, but appeared as the operation of a general law of vital decline, acting uniformly, and, more satisfactory still, where this real unity could be clearly demonstrated through every phase and degree; from its first and normal type of restorative reaction in an *ephemera* of healthy resolution, to its last phenomenon, where, the physical resources of the human frame exhausted, death ensues, as the natural consequence of a mortal existence. In such a grand school of medicine as this, so surrounded with self-evident truth, or mutually interpreting facts of effect and relation, observation and experience would soon produce an Hippocrates capable, by a few axioms, and consequent deductions in the form of rules, to lay down a simple but sufficient system of public *hygiene*, that would meet, as far as human wisdom could do, the exigencies of situation and climate, otherwise calculated to occasion serious and extensive disease among a numerous population.

The benefit, however, could only result from the general adoption of the discipline, and to do this it would be necessary to make its observance a kind of social institution. Fortunately for human nature, the condition implied by a low degree of civilization is at all events extremely favourable for the exercise of authority, based upon superior intellect, and directed by benevolence and justice. A divine humanity will be found to characterize the history of all celebrated law-givers. And religion, whether inculcated as a moral duty, or an astute policy, has in all ages been the powerful agency through which these benefactors of their kind have sought to establish their influence, and carry out their projects of reform in manners and institutions. This, in my opinion, was the origin of fasts and festivals, in connection with religious ceremonies. Victims of bodily suffering, especially in a country where carelessness, and selfish indulgence, are the principal causes of debilitated constitutions, could be easily convinced of their own erring instrumentality in producing the evils of which they complained, and advantage would be taken of this circumstance by medical advisers, such as I am alluding to, as belonging to the priestly profession in remote times, to impress upon their patients, that if, as it seemed, they were suffering in the body a retributive punishment, repentance, to bear fruit in cure, must be accompanied by some penance, involving more or less of bodily discomfort. Abstinence would thus become inculcated as a religious duty; and the surest remedy in the cure of disease, where this was possible, would naturally soon be made a sacred obligation. Personal opinion satisfied, it would be easy to expand the application of the principle of fasting into a public observance, especially during the prevalence of some great sickness, or to commemorate with useful humility the anniversary season of some desolating pestilence, which the sagacity of the priest-physicians enabled them to connect with indulgence in animal food, and which culminated in an epidemic disease, sometimes in a highly aggravated form, at that particular period of the year.

Such appears to have been the very sensible origin of fasts, in a country fortunately situated to suggest general principles, such as I have been commenting upon, and I may tell my readers that it could not be more so than Natal really is. From this happily constituted locality, a

system of public *hygiene*, suited to the circumstances of the climate, seems to have been suddenly transferred, with the religion in which it originated, to other countries, without any inquiry relative to its adaptation to the new situation. A succeeding term of social disquiet and disturbance further interfered with proper adjustment, and led, in the course of a generation or so, to the whole theory and policy of the practise being forgotten and lost; only preserved in a ceremonial of superstitious observance, favoured in this respect by the bigotry always associated with ignorance.*

My object in making these remarks will be easily perceived. Imperfect nourishment in Natal I consider to be the first source or origin of all its forms of disease—the insufficient supply of nervous power leading to imperfect

* What remains to prove the original character of the geographical situation of ancient Europe, at a time when the *embouchere* of the Nile was into the Red Sea, seems to show that it particularly favoured the seclusion of a peace-loving people, piously depending upon the direction of an enlightened and honest theocracy, such, in fact, as is required to realize the origin of fasts in the manner described above. Circumstances materially changed when, after many centuries of succeeding inundations, the bed of the Nile was at length lifted up, as on a natural aqueduct, to a level sufficient to direct its waters in the direction of the Mediterranean. At once a way was opened for contaminating intercourse with, and the more serious assaults of, the piratical inhabitants of the Ionian Archipelago, which ultimately resulted in a conquest of Egypt by the Greeks, and the subversion of its once pure religion (the faith of Abraham, of Isaac, and of Jacob,) into an absurd mythological *travestie*. Christianity is reacting on this in strict accordance with the old principle of preserving the non-essentials, whilst it immolates the main principles. Idolatry exists now only in idle ceremonies, and a transcendental belief, grafted by heathen philosophy, upon a loudly professed recognition of only one God. Reflections like these close almost with conviction, when, on man's regaining a country, the climate and situation of which is intimately related to that of the original seat where many of these observances were instituted, to find how remarkably suited they are to promote the health of the inhabitants. For example, I will adduce the instance of the forty days' fasting in Lent, which in the northern hemisphere, occurring in early spring, serves no other purpose but to mark the faithful in a particular creed, who may perhaps derive some spiritual benefit. To this, however, in Natal, is added great physical advantages, as the time of occurrence being in the most unhealthy season, the abstinence from all animal food tends materially to protect good Roman Catholics from many of the ills of the flesh that fall to the lot of the less consistent members of the Established Church.

natural efforts in the constitution, to counteract adverse influences operating upon the frame from different conditions of weather, or other accidents of exposure. In temperate countries of the northern hemisphere, the difference between heat and cold is well known to be met by the inhabitants generally selecting, in hot weather, salads or other vegetable food, and in winter, on the contrary, fat animal meats. In Natal, in addition to varying temperature, we have to provide against extreme variations in the amount of moisture in the atmosphere, which, on the one hand, when saturated completely, arrests perspiration, by the air refusing to receive any addition to its burden of vapour; and, on the other, when perfectly and continuously dry, promotes an excessive drain of the fluids of the body through the pores of the skin, by the process termed insensible perspiration, because it is equally active during rest as when the body is in a state of active exertion. As a general proposition, also, in a climate like that of Natal, the chemistry of the human system is exposed to great electric vicissitudes, sufficiently exemplified for my present purposes in the ready facility of decomposition under circumstances of moisture, and its comparative arrest in extreme dry and cold weather. All these varying meteorological conditions have to be considered, and as nearly an equal and constant effect produced upon the human frame as possible, or the incongruity is immediately betrayed in unpleasant feelings, which constitute ill health, more or less, as constitutions vary in resisting these disturbing influences. Whilst I do not deny the importance of bathing, as a ready means of equalizing the necessary fluid requirements of the body with contingencies of weather, I cannot, however, help supposing, that it is chiefly in the selection of food, and a proper discipline of diet, that the greatest hope is to be entertained of successfully contending with the adverse relations of external nature I have just alluded to. In considering the next proposition, I have taken the opportunity of commenting upon the results of observation in disease, as pointing out the relative value of animal or vegetable food, and therefore here shall only remark, that the next dietary principles which seem to promise in Natal the most available benefits to health, is abstinence on the one hand, and wisely instituted festivities on the other. This, however, is a field of inquiry and observation as yet unworked, and which I can only allude

to in the most general terms, promising for myself—and hoping others will join in the good work—to watch with earnest and curious zeal for every indication of light, to show what ought to be done in establishing an annual system of fasts and festivals, which at some future time will, no doubt, testify to the wisdom and prudence of the inhabitants of Natal.

The *second* proposition is less patent, but equally true and useful in its application to the treatment of nervous indigestion in adult life. It seems that in perfectly healthy systems, as I am presuming childhood presents, whatever disturbance may arise from epidemic influence, is developed in a situation that may be considered furthest from the great centres of vitality—the brain and heart. This is the skin, whether external, on the surface of the body, or internal, as the lining membrane of the alimentary canal. Here the most active symptoms of excitement and of cure appears, in the form of increased vascular action, with a ready tendency to relaxation, evidenced in slighter cases by general perspiration, and in graver ones by a discharge of viscid slime along the whole course of the alimentary canal—the characteristic feature of catarrhal influenza. On the other hand, in adults, where a vital change in functional economy has taken place, and additional vigour in certain organs obtained at the expense apparently of the susceptibility of the skin, the same natural law still directs the evidences of diseased action to the extremities of the system; but which now is apt to be developed as spasmodic contraction in the capillaries—a feature, as will be observed, the very reverse to the critical relaxation which attends upon, and specifically marks the spontaneous cure of infantile disorder. It was observing this that suggested my *second* proposition, to the effect, that to relieve the nervous fever of Natal, all that is required is to establish, as soon as possible, a general relaxation of the capillary system on the surfaces of the body, internally and externally, but with this momentous caution, that whatever is done shall add nothing to the irritation and exhaustion existing, and which, in fact, constitute the disease. Perhaps, however, it will be as well to relate the experience that led to my own convictions upon the subject; whilst at the same time I shall have an opportunity of describing the treatment, which I find to be quite equal, as I have before remarked, to reduce the radical disease of the

country to its true and proper character, of a common cold.

It would be a long while before the connection of *hemorrhoids* with *cynanche tonsillaris* would be observed in England, yet there can be nothing more clearly demonstrated in Natal, than that they are allied developments of disordered action in the mucus membrane of the alimentary canal, differing in seat and character from the peculiar influence upon capillary economy exerted by circumstances of climate and constitution, according to a specific law of pathognomonic development, which operates diversely in opposite hemispheres. The prolonged irritation in the esophagus (swallow), in many cases of simple relaxed uvula, as well as in ordinary sore throat, the usual accompaniment of catarrhal influenza in adults, first directed my attention to the probable relationship of the two affections, especially as a corresponding indication of a similar congested condition of the lining membrane of the stomach, causing heart-burn, was frequently complained of at the same time. The choleric symptoms often present, seemed also connected with this radical cause, and as I observed, during the prevalence of the epidemic, that many persons who escaped were, however, attacked with hemorrhoids (another congested state of the mucus membrane of the bowels), I was naturally led to infer that the freedom these latter enjoyed from the prevailing illness was due to this peculiar curative effort in the system. It also afforded me the necessary clue to explain the real nature and connexion of the many differently seated symptoms, which in the northern hemisphere, being apt to assume the character of local organic inflammation, are raised to the importance of separate diseases, by centering attention upon the seat, in each particular case, of the most obvious danger. In Natal, however, having observed in children how sufficient nature's own efforts were to relieve the most prominent symptoms of a prevailing epidemic, and noticing that this was effected by determining to the lining membrane of the bowels a discharge of a viscid mucus or slime; seeing, further, that the source of impunity was sufficient nutrition, enabling the vital powers to contend successfully with adverse influences operating from without, I felt that I was supplied with an amount of information it would have been impossible to have acquired from an experience in Europe alone. Practise soon confirmed the observations, and as the *modus*

operandi of the curative instinct of nature was so clearly developed, the simple principles upon which I base my treatment of disease in Natal, required no great amount of sagacity to discover, and apply in a general way, for the relief of the same symptoms occurring in adults.

The greatest difficulty I found was to resolve or disperse a considerable degree of congestion, either in the brain, the liver, or the lungs; add to which, in women, the ovaries of the womb. This tendency was the climatic analogue in the southern hemisphere of the inflammatory disposition in the northern; and the natural remedy is the catarrhal defluxion on the bowels so often mentioned. My aim in cure, therefore, was to produce medicinally a similar discharge, and to do this I found nothing equal to my favourite combination of calomel and jalap, in doses proportionate to age. The former has long been known to act as a sedative in nervous irritability—hence its value, I presume, in a climate like that of Natal. Jalap, again, has a relaxing effect upon the mucus lining of the bowels, and thus facilitating a discharge of mucus, just as *ipecacuanha* acts upon the corresponding membrane of the air cells and tubes in *bronchitis*. Its purgative effect, of course, is useful, but this is not the specific object for which it is given, and there is no other cathartic in the *materia medica*, the operation of which is so certain and efficacious in producing the particular effect upon the capillary system in the bowels, required in the *catarrhal influenza* of Natal.

The difference between *catarrhal influenza*, and the common remittant or nervous fever in Natal, is a good example of that variation in the development of disease, which is occasioned by the changed circumstances of life at puberty. The febrile symptoms of the first stage in both, are of a like continued character; and, let it be observed, are the same with those which in England attend upon the eruptive diseases of childhood—such as measles, scarletina, small-pox, &c.—and also accompany active organic inflammations—the scourge of the northern hemisphere, but which, as a rule, never seriously occur in Natal. I have shown how the nature of the crises of the several attacks in the two situations, is determined by some general, but distinctly different influences operating upon the human constitution; so that whilst, on the one hand, the excitement of the first stage, unrestrained by any natural effort, leads to the characteristic rupture and disorganization of tissue, on the

other, quite as critical a phenomenon terminates the stage of excitement, by a prostration of vital power, or collapse, which leaves the system unequal to that successful effort of daily adjustment, which starts every fresh term of twenty-four hours, with an obtained healthy mean between nervous sensibility and the stimulus of the blood. In childhood, this disordered condition, as I have before observed, is naturally relieved by a slimy discharge from the bowels, and if proper nourishment be given the cure is certain. It will also be found, in the common nervous fever of the country, that although the spontaneous operation in the alimentary canal now seems lost, those medicines which determine a corresponding action, such as cathartics, with particular attention to diet; or, in other words, a treatment corresponding to nature's indications in childhood which relieves the blood of some obnoxious fluid constituent, and replaces it by required nutriment, will speedily and surely conduce to a happy recovery, whilst any other course will afford very questionable relief, and at the best only lead to a protracted cure. Since I became conscious of this natural alliance between the catarrhal affection of infancy, and the remittent nervous fever of adult life (especially imminent in Natal during the transition age of puberty), I have not had a case, the serious symptoms of which extended beyond the first stage, and attention to the suggestions I have here thrown out, will allow of a degree of confidence in prognosticating a favourable termination, which medical men can well understand the pleasure and value of in intercourse with patients and their friends.

To complete my observations, it is here necessary to add, that the prominent symptoms of an attack of nervous remittent fever, which generally makes its appearance as an epidemic, are drowsiness, or a tired languid feeling, with a hot dry skin, occasional chills, followed by flushing heats. The pulse is full and frequent, with constant nausea and headache, all, of course, varying in intensity according to the degree of attack, and usually increasing in severity towards the close of day. In the night, disturbed sleep, and even delirium, will be present from the commencement. My usual course is to order a simple antimonial emetic; but in that variety which is ushered in by symptoms of colic or cholera (spasmodic pain in the stomach and bowels, with vomiting and diarrhoea), mustard will be found the most effectual and safe. After the operation is completed,

a calomel and jalap powder, according to age, should be given, with a small basin of cordial gruel or sago, with a little spirit added. If the attack is severe, and there is evident constitutional determination of blood (congestion, or obstructed circulation) to some particular organ—usually the brain, the lungs, or the liver—promptly enveloping the region in a thick but light swathe of wetted cloth, over which a dry flannel roller is wound to confine the heat and moisture, will amount to a local warm bath, and give almost immediate relief. The “packing,” as this sort of bandage is called, may be kept on till dry, or repeated, if necessary, with perfect safety. Attention should always be paid to the careful administration of cordial farinaceous drinks every three hours, and if the symptoms have not subsided, or evidently relieved, it may be necessary to repeat the c. *cum* j. powder in twelve, or even in six hours. It must be a very bad case indeed, or the circumstances such as can only indicate a mortal attack, where this treatment is insufficient to relieve all anxiety in the course of the first stage. If the illness, however, is allowed to proceed too far before proper assistance has been rendered, the symptoms of nervous exhaustion, and the consequent want of rallying power, is superadded to the first cause of depression, and to the effects already produced in the system by its morbid operation.

Should these adverse circumstances occur in a frame invaded by a long term of specific *indigestion*, having no sufficient reserve of vital power to react in a time of positive disease, a provision always characteristic of health, the case will assume all the dreaded features of low typhus fever, and the patient be in a very critical, if not a dangerous state. This condition, however, is always to be attributed to the ignorance or carelessness of the patient's friends and attendants, in deferring professional aid until too late to arrest the progress of the disease; and when all these evils appear concentrated, as against one unfortunate life, it has a significance more than human, either to mark some moral change necessary to its future destiny, or else comes like any other accident, as a messenger of death to close an appointed time. My experience, often painful, tells me that a medical man, unless he be providentially selected to assist in cure, can do very little good himself, with any confidence in the result. At all events, I may be excused prescribing any specific treatment for the thousand and one aspects of disordered action, such

a complication of adverse circumstances may assume. I keep always in view the radical principle upon which the unity of disease is based—the want of reactive vitality in the system, occasioned by insufficient nutriment, according to which idea the only chance of maintaining permanent reaction depends upon a supply of proper food. The next most useful thing to be remembered, is that in allied cases of vital depression, arising from some external influence (generally meteorological, but sometimes consequent upon a severe injury, or on insufficient or unwholesome food), nature successfully throws off the attack, by determining to the surface of the bowels a mucus discharge derived from the blood—a hint that cannot mislead, and the value of which, in administering my favourite doses of calomel and jalap, I have been led to appreciate, almost to an empirical confidence, that if anything will do good, especially in extreme cases, this medicine is the most to be relied upon. However, great benefit may be also derived from small doses of the tincture of capsicum (cayenne) fifteen or twenty drops every two or three hours, in a table-spoonful of simple syrup, and a little rice or barley water. Ablution, at least twice a-day, of the whole body, in luke warm water, and with common yellow soap, carefully performed by the nurse, so as to disturb and fatigue the patient as little as possible, is useful, as it not only favours the removal of any natural secretion from the pores of the skin, but also admits of a considerable quantity of fluid being absorbed, and conveyed into the blood, when the ordinary supply through the absorbents of the stomach and bowels is prevented, either by the partial paralysis or palsy of the alimentary nerves; or by some mechanical obstruction, like viscid mucus, hermetically, as it were, closing up the mouths of these minute vessels. Lastly, I would recommend in aid, the frequent application of ordinary smelling salts to the nose, a means of administering medical relief in cases of nervous disorder, that is too often overlooked and neglected; but, as in typhus fever, one of the most prominent morbid appearances after death, is a highly congested condition of the membranes of the brain, it suggested to me the direct application of some stimulant in the manner I have just recommended, and from the use of which I have, I believe, frequently derived very considerable assistance.

But before concluding my remarks upon the nervous

fever of Natal, it is necessary to say a few words upon the imminent danger to which patients are exposed in case of relapse, as it is termed ; but which, in fact, exhibits nothing of the true febrile character, being more nearly allied to that condition of the body observed in a severe attack of *delirium tremens*, when the first stages of excitement have terminated in collapse. Great irritability of the stomach, with constant sickness, is generally the most distressing symptom, accompanied with a thin and hurried pulse, the pupils largely dilated, and restless delirium, indicative of nervous exhaustion, and extreme prostration of the vital powers. Nor is the relapse always commensurate with the violence of the original attack, but is sometimes most to be feared in those cases that have easily, as it seemed, passed through the several stages of the fever, and have been thus led too early to resume ordinary avocations. I always warn my patients that they are in far greater danger during the first week of convalescence than at any time of the preceding illness, advising, accordingly, the greatest care, not to excite or exhaust themselves by any over-exertion, or exposure to the sun. My treatment is confined to cautious nursing and quiet repose. Medicines I have long ceased to trust, for where recovery took place, there was no reason, as I saw, to attribute it to their use, whilst, on the contrary, when unavailing, I have had reason to wish I had done nothing at all. Applying the turban warm bath to the head, by the usual swathe bandage, excluding all light, and imposing the strictest quietness, of course tend considerably to allay excessive nervous irritability, and are so far useful directions to be given ; but the most important thing is nutriment, in such form, and of such a character, that will least exhaust the little that remains of vitality, even in so much as is required for the process of digestion. Aromatic smelling salts, frequently inhaled ; warm brandy and water ; milk and tea, in equal parts, well sweetened ; vegetable jellies ; gently washing the body and limbs with luke warm water and soap (to which, in my next serious cases, I shall certainly add some proportion of sugar), are all I can venture to recommend as having been found to prove useful.* The most threatening appearance is when he-

* In cases of successful resolution (dispersion) of threatened abscesses in the breast, and of ordinary Natal boils, by the application of large plasters of soap and sugar, I feel assured that a

morrhage from the nostrils, or the stomach, the lungs, or the bowels, bear testimony to the extreme debility of the minute terminations of the blood-vessels ; and this untoward symptom, I have had occasion to believe, was owing to an undue *impetus* of the blood, overpowering the delicate fabric of the extreme capillaries, still weak and relaxed, when the muscular fibres of the heart had been prematurely invigorated by too early administering animal food, in the shape of beef tea, mutton or chicken broth, &c. At all events, I am jealous of too good nursing in this direction, and am led accordingly to make the remark that, though recovery is a matter altogether of proper nourishment, overdoing what is right, is equally as dangerous as going wrong, from ignorance or neglect.

So much for the low nervous fever of Natal ; the only serious illness to which the inhabitants may be said to be exposed. It has several differently characterized forms, the varieties being called bilious, gastric, brain, or rheumatic fevers, according to the seat of the greatest developed congestion, and which is determined by peculiar constitutional tendencies. The best proof, however, that they are due to the same radical disturbance in the economy of the human body, is the fact, that the treatment in all is one and the same. Its exciting cause seems to be the operation of some extraordinary depressant of external origin, supplemented upon *nervous indigestion*. Under ordinary circumstances of good health, nature—the *vis medicatrix naturæ*—is sufficient to resist and throw off any assault of the kind ; but where the supply of vital power has not been properly sustained by the use of good food, or where its undue expenditure, by over exertion or exposure, is not carefully compensated for by sufficient supplies, the *stimulus* of the blood, by the law of daily adjustment, is continually being adapted to the lowered tone of nervous energy, and

great part of the relieving process is due to direct nourishment, taken up by the neighbouring absorbents of the skin, and applied to the requirements of the debilitated and weakened parts. Under the influence of vital analysis, sugar seems easily resolved into its constituent elements, which admits of a vicarious process of digestion being instituted through the medium of the absorbents of the skin. Hence the addition of milk or wine to baths, sometimes recommended ; and cases are reported of the sustenance of life for several days by occasional immersion in light meat broths. Than all these, however, I have most reason to prefer the use of sugar.

of course to the depreciation of constitutional strength generally. In short, functional energy varies with nervous power, and nervous power proceeds from the circulation into which it has been introduced, by the due conversion of food into this vital element. Carelessness in diet leads to diminished supply, and diminished supply renders natural reaction in the system weak and failing. The répose of night barely balances the exhaustion of the day, and when this natural equilibrium, which is the economic object of a term of rest succeeding a term of action, is not supported by proper nursing or domestic care, the *stimulus* contained in the blood, and *organic sensibility*, are reduced to a *minimum*. Health is then only sustained under the most favourable external circumstances, for the adjusted mean of these vital re-agents, being thus brought gradually to the lowest point compatible with the maintenance of the ordinary functions of life, it is always liable to sudden subversion on any extraordinary emergency, either of meteorological or accidental origin.

One observation upon the treatment of this fever affords excellent illustration of the value of my second proposition. Any action upon the skin it may be necessary to produce is much better effected by the packing system of wet bandages, rather than by the administration of saline medicines, such as are usually employed in England. An aromatic mixture, as a local stimulant upon the stomach, or even a weak glass of warm brandy and water, I have found much more safe and useful. Nor is this a mere empirical assertion, but has been proved over and over again by an inquiring observation. Nature, in this colony, does not seem able to stand the specific diaphoretic or diuretic operations which particular medicines exert in the skin or kidneys. The increased activity they temporarily excite in the capillaries, is followed by a corresponding exhaustion, all chances of adding to which should be carefully avoided, as the low fever of Natal is altogether one of depression. The wet bandages, like so many local warm baths, promote the same object, of a discharge from the skin, but with a decidedly soothing effect, by allaying the abnormal irritability, and so naturally relaxing the febrile spasm, which is obstructing the circulation in the skin, and oppressing the internal organs by the congestion which necessarily follows this interruption of the blood in its usual course.

For a somewhat similar reason blisters must also be avoided in Natal. The ordinary fever of the country is due entirely to nervous debility, and is characterized by a morbid sensibility on the surface of the body, which occasions a most disproportionate disturbance in the system on any approach of pain, exactly similar to the aggravating effect of light in analogous cases of irritable optic nerve. To apply a red-hot brazen bowl to the eyes of a patient under such circumstances, is not less reasonable than to employ blisters and mustard poultices, with the view of resolving spasmodic congestion in a morbidly sensitive skin. They only increase the danger, by aggravating the subsequent collapse. When the excitement is clearly vascular, and the phenomena those of active inflammation in European experience, I know the value well enough of counter irritation; but under the reversed circumstances of diseased action in Natal, the treatment of apparently the very same symptoms require the greatest care, not to increase the existing nervous debility, but to sooth and support the system by means approaching, as nearly as possible, to those which we see nature so successfully employ in the case of infants. and which it has been my object in these remarks to point out and promote.

The third proposition has been suggested by a knowledge of the critical times and circumstances which mark the daily adjustment in the system, to which I have called particular attention. The rule is, to give this natural law of reaction the best opportunity of restoring expenditure, by due refreshment. It is to this end that, during the night's repose, the vital powers, rescued for a term from the restless extravagance of the human will, are economically directed, and divinely nursed, to compensate for the wear and tear of active life. We also see, that in *nervous indigestion*, betrayed as hectic debility, or exaggerated by epidemic influences, the crises of febrile excitement accord so far with the set periods of exhaustion, and required repose, in good health, as always to happen towards the decline of day, a circumstance which admits of being improved by the appliance of every possible aid, to promote the genial reaction natural to the time. What this is, can be best understood by first considering the phenomenon of extreme debility, irritable spasm in the capillaries, which is followed by the collapse of exhaustion, whenever sufficient vital power to react is wanting. The healthy reverse of this is

a gently relaxed condition of the skin, admitting of a transpiratory process, in which the act of adjustment between the circulation and the nervous system seems chiefly to reside. It sometimes amounts to perspiration, when the need of the system is greater, and the *vis medicatrix* is equal to the effort. It is obvious, therefore, that a little assistance from art—a warm bath, for instance,—would be sufficient in many instances, where constitutional strength might be wanting, to enable systems to establish the proper restorative reaction in the skin, and the effect would be much more considerable, if, during the day, a cautious expenditure of nervous power had also been provided for, in a diet requiring little digestive exertion, and by a quiet repose, which would preserve a corresponding inactivity in the muscles of the body.

In more serious cases, where *nervous indigestion* threatens life by rapid exhaustion of vital powers—as, for example, in that form of extreme nervous prostration which follows miscarriage, attended with great loss of blood, or even in suckling mothers overnursing their offspring; but more especially in the excessive nervous irritability consequent upon an aggravated attack of *delirium tremens*, or which, as relapses, supervene upon common nervous fever,—the exhausted frame sometimes sinks irretrievably, in a culminating fit of collapse which occurs in early morning. I have found by experience this most critical time extends between the hours of one and three; and it is a significant fact, that statistical inquiry has proved that in Europe the greatest number of deaths take place in or about this portion of the twenty-four hours. To guard against these crises of extreme depression, is still more important than to meet the debilitated, and therefore imperfect, efforts of restorative reaction in the afternoon. All that is required is to be prepared with some nutricious cordial drink, to be given the first available opportunity after midnight. Generally, at the time required, an increased restlessness will be observed in patients who are still labouring under fever, or, if advancing towards cure, a sudden wakening up from sleep—indications which ought to be immediately attended to in the way I have prescribed; and after nature's evident need of the auxiliary spur has been supplied, it is pleasing to watch the contrasting tranquillity that almost immediately ensues. When I caution convalescents of the danger to which they are exposed of a relapse, for two or three

weeks after an attack of nervous fever, I never omit the recommendation of their being provided with some slight repast, if only a crust of bread and a glass of water, to avail themselves of in early morning, on first awakening from sleep.

The requirements of the female constitution may be also most usefully consulted, when nature, at her monthly crises, is most disposed to aid in correcting some cumulative excess in the circulation, and, by an extraordinary exertion, re-assures the otherwise threatened balance of the vital forces in the human economy. Many men in Natal indisputably participate in this periodic adjustment so decidedly marked in women ; and either from an hemorrhoidal discharge experience considerable relief in the general system, or else suffer more or less from symptoms of a plethoric fulness in the head, low spirits, or *nervous indigestion* in the form of a three or five days' bilious or gastric fever. In all these cases, however, it is not unusual for one dose of calomel and jalap powder, in addition to its ordinary effect, to produce what may be termed in such cases a natural discharge of blood from the bowels, and gives immediate relief.

Bathing, as I have before observed, is a very available means of assisting the daily adjustment of vital forces in the body. It is popular knowledge how immersion of the lower extremities in warm water, on retiring to rest, tends to sooth the irritability of fatigue, or, by promoting perspiration, relieves the tendency to internal congestion occasioned by exposure, or which characterizes an ordinary cold. In the countries north and south of the Mediterranean Sea, warm bathing is a general social institution, and a source of luxurious indulgence. It ought to be so in Natal, and will, no doubt, when the colony is more advanced. In early morning a cold bath seems to recommend itself instinctively, and its enjoyment is the surest test of good health, for in irritable, weak constitutions, a disagreeable sense of shuddering reluctance to come into contact with water, betrays a morbid sensitiveness in the skin that tells of flagging vitality. Of course this remark applies chiefly to young persons, and the middle aged. In the former, under such circumstances, a morning shower-bath would tend to counteract the constitutional debility ; in the latter, if unusual, it indicates some neglect or error in diet, and is premonitory or indicative of *nervous indigestion* having commenced its inroads upon the constitution.

Another aid to vital adjustment, especially during the attacks of common nervous fever, is perfect rest, or repose, in a room that admits of an even temperature being preserved. A door opening will sometimes make a difference of several degrees of heat, and occasion a corresponding disturbance in the sensitive, excited system of a patient, and at the very moment, perhaps, when nature, passing through a crisis, whether of restorative excitement, or threatening collapse, trembles between life and death. It is useful, also, carefully to exclude light, which is an exhausting stimulant acting through the optic nerve. So much vital power is therefore economised, and made available for healthy reaction. In fact, it would appear that the nearer we can keep the patient in a condition approaching that of natural repose in the night, the more surely are we aiding in any efforts of the system to relieve itself. Equal temperature, genial warmth, quietness, recumbent rest, and obscured light, are all remedial agents of the greatest value. Attention to these constitute good nursing, and, in Natal, it must ever be kept in view, that the greater part of the treatment of disease consists in a careful, continued solicitation to support and encourage nature, in her spontaneous endeavours to throw off whatever of evil is oppressing and threatening the human economy.

Here, for the present, I bring to a close my observations upon health and disease in Natal. Not that I have included much that perhaps might have been usefully commented upon, but that I was afraid the patience of my readers was already tried too much by the discursive and digressive character of what has been written on a subject, not in itself very attractive, and affording little opportunity to please and entertain. When I commenced, the importance of many questions raised in the course of the inquiry, upon the causes of the differences observed in the character of diseased action, as observed in Natal and in Europe, had never occurred to me; otherwise, in projecting my work, I would certainly have selected a professional, rather than the popular plan upon which I have carried out my design. Scantly provided with medical attendance, the widely separated population of a colony require special instruction upon the treatment of disease, especially if, as in Natal, the appearances are so apt to belie the real nature of the attack. The delusions of *delirium tremens*, removed from the sphere of the optic nerve, and developed in that of touch

or feeling, are far less capable of being detected as such, and their true character recognized, by the patient's friends; whilst if any value or importance is attached to them as indicative of active organic disease, such as the symptoms would warrant in England (and the treatment adopted which is recommended in works upon domestic medicine written there), the most serious consequences would ensue. Under such novel and extraordinary circumstances, my object has been to inform my non-professional brethren upon many matters essential to the maintenance of good health in Natal, and I have therefore addressed myself to them in a manner, and in language, that I thought best calculated to convey my meaning, although frequently open, I dare say, to the charge of being too general in my definitions, by those medical critics who may wish to follow up some of my conclusions in an ultimate analysis. But if I am spared they shall still have their chance, when in another form I give the result of my professional experience, as a contribution, good or bad, to medical literature. In the meantime I have only to court discussion with my fellows in the healing art, labouring in the same field, and shall be glad, indeed, if the world-wide importance of many of the suggestions I have made should first meet with that sifting inquiry in Natal, which they must undergo before being received as part of general knowledge.

THE END.

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